

The California Evaluation Framework: Appendices

**Prepared for the California Public Utilities
Commission and the Project Advisory Group**

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DRAFT

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Appendix A: Glossary of Terms

ACCESS CHARGE - A charge paid by all market participants withdrawing energy from the ISO controlled grid. The access charge will recover the portion of a utility's transmission revenue requirement not recovered through the variable usage charge.

ACCURACY - An indication of how close some value is to the true value of the quantity in question. The term could also be used in reference to a model, or a set of measured data, or to describe a measuring instrument's capability.

ACHIEVABLE POTENTIAL - The amount of savings that can occur in response to specific program designs and delivery approaches, including program funding and measure incentive levels. Achievable potential studies are sometimes referred to as Market Potential studies.

ADDITION - An alteration to an existing building that increases conditioned space.

ADMINISTRATOR - A person, company, partnership, corporation, association, or other entity selected by the Commission and any Subcontractor that is retained by an aforesaid entity to contract for and administer energy efficiency programs funded in whole or in part from electric or gas Public Goods Charge (PGC) funds. For purposes of implementing PU Code Section 381.1, an "administrator" is any party that receives funding for and implements energy efficiency programs pursuant to PU Code Section 381. Similarly, a person, company, or other entity selected to contract and administer energy efficiency programs funded by procurement funds.

AFTER MARKET - Broad term that applies to any change after the original purchase, such as adding equipment not a part of the original purchase. As applied to alternative fuel vehicles, it refers to conversion devices or kits for conventional fuel vehicles.

AFUE – See ANNUAL FUEL UTILIZATION EFFICIENCY

AIR CHANGE - The replacement of a quantity of air in a space within a given period of time, typically expressed as air changes per hour. If a building has one air change per hour, this is equivalent to all of the air in the building being replaced in a one-hour period.

AIR CONDITIONING COMFORT - Treating air to control its temperature, relative humidity, cleanliness, and distribution to meet the comfort requirements of the occupants of the conditioned space. Some air conditioners may not accomplish all of these controls.

ALTERNATIVE ENERGY SOURCES - See RENEWABLE ENERGY.

AMBIENT AIR TEMPERATURE - Surrounding temperature, such as the outdoor air temperature around a building.

AMPERE (Amp) - The unit of measure that tells how much electricity flows through a conductor. It is like using cubic feet per second to measure the flow of water. For example, a 1,200 watt, 120-volt hair dryer pulls 10 amperes of electric current (watts divided by volts).

ANALYSIS OF COVARIANCE (ANCOVA) MODELS - A type of regression model also referred to as a “fixed-effects” model. This model allows each individual to act as its own control. The unique effect of the stable, but unmeasured characteristics of each customer is their “fixed effects;” from which this method takes its name. These fixed effects are held constant.

ANNUAL FUEL UTILIZATION EFFICIENCY (AFUE) - A measure of heating efficiency, in consistent units, determined by applying the federal test method for furnaces. This value is intended to represent the ratio of heat transferred to the conditioned space by the fuel energy supplied over one year. [See California Code of Regulations, Title 20, Section 1602(d)(1)]

ANNUAL MAXIMUM DEMAND - The greatest of all demands of the electrical load which occurred during a prescribed interval in a calendar year.

ANSI - American National Standards Institute is the national organization that coordinates development and maintenance of consensus standards and sets rules for fairness in their development. ANSI also represents the USA in developing international standards.

APPLIANCE EFFICIENCY STANDARDS - California Code of Regulations, Title 20, Chapter 2, Subchapter 4: Energy Conservation, Article 4: Appliance Efficiency Standards. Appliance Efficiency Standards regulate the minimum performance requirements for appliances sold in California and apply to refrigerators, freezers, room air conditioners, central air conditioners, gas space heaters, water heaters, plumbing fittings, fluorescent lamp ballasts and luminaires, and ignition devices for gas cooking appliances and gas pool heaters. New National Appliance Standards are in place for some of these appliances and will become effective for others at a future date.

APPLIANCE SATURATION - A percentage telling what proportion of all households in a given geographical area have a certain appliance.

AREA LOAD - The total amount of electricity being used at a given point in time by all consumers in a utility’s service territory.

ASHRAE - Acronym for American Society of Heating, Refrigerating and Air-Conditioning Engineers.

AUTOCORRELATION - The breakdown in the assumptions that the errors in regression analysis are uncorrelated due to correlation in the error term across observations in a time-series or cross-series, the error in one time period is directly correlated to the error

in another time period or cross-sectional category. First-order serial correlation is where that correlation is with the error in the subsequent/preceding time period. The correlation can be positive or negative.

AVERAGE COST - The revenue requirement of a utility divided by the utility's sales. Average cost typically includes the costs of existing power plants, transmission, and distribution lines, and other facilities used by a utility to serve its customers. It also includes operating and maintenance, tax, and fuel expenses.

AVERAGE DEMAND - The energy demand in a given geographical area over a period of time. For example, the number of kilowatt-hours used in a 24-hour period, divided by 24, tells the average demand for that period.

AVOIDED COST - (Regulatory) The amount of money that an electric utility would need to spend for the next increment of electric generation to produce or purchase elsewhere the power that it instead buys from a cogenerator or small-power producer. Federal law establishes broad guidelines for determining how much a qualifying facility (QF) gets paid for power sold to the utility.

BASE LOAD - The lowest level of power production needs during a season or year.

BASE RATE - That portion of the total electric or gas rate covering the general costs of doing business unrelated to fuel expenses.

BASELINE DATA - The measurements and facts describing facility operations and design during the baseline period. This will include energy use or demand and parameters of facility operation that govern energy use or demand.

BASELINE FORECAST - A prediction of future energy needs which does not take into account the likely effects of new conservation programs that have not yet been started.

BASELINE MODEL - The set of arithmetic factors, equations, or data used to describe the relationship between energy use or demand and other baseline data. A model may also be a simulation process involving a specified simulation engine and set of input data.

BASELINE PERIOD - The period of time selected as representative of facility operations before retrofit.

BENCHMARKING - A process that compares a 'set of results' against industry best practices.

BIENNIAL REPORT - The report issued by the California Energy Commission to the Governor and the Legislature every odd-numbered year assessing California's energy industry. The Biennial Report is supported by four policy documents that are issued every even-numbered year: the Electricity Report, the Fuels Report, the Conservation (or Efficiency) Report and the Energy Development Report.

BILATERAL CONTRACT - A two-party agreement for the purchase and the sale of energy products and services.

BILLING DATA - Has multiple meanings. Metered data obtained from the electric or gas meter used to bill the customer for energy used in a particular billing period. Such meters typically conform to regulatory standards established for each customer class. Also used to describe the data representing the bills customers receive from the energy provider and also used to describe the customer billing and payment streams associated with customer accounts. This term is used to describe both consumption, demand and account billing and payment information.

BILLING DEMAND - The demand used to calculate the demand charge cost. This is very often the monthly peak demand of the customer, but it may have a floor of some percentage of the highest monthly peak of the previous several months (a demand “ratchet”). May have other meanings associated with customer account billing practices.

BIOMASS - Energy resources derived from organic matter. These include wood, agricultural waste and other living-cell material that can be burned to produce heat energy. They also include algae, sewage and other organic substances that may be used to make energy through chemical processes.

BRITISH THERMAL UNIT (Btu) - The standard measure of heat energy. It takes one Btu to raise the temperature of one pound of water by one degree Fahrenheit at sea level. For example, it takes about 2,000 BTUs to make a pot of coffee. One Btu is equivalent to 252 calories, 778 foot-pounds, 1055 joules, and 0.293 watt-hours. Note: the abbreviation is seen as “Btu” or “BTU” interchangeably.

BROADCAST MESSAGE - A message (typically an ad) broadcast over a mass medium such as television, radio or newsprint.

BUILDING COMMISSIONING - Building commissioning provides documented confirmation that building systems as constructed function in accordance with the intent of the building designers, and satisfy the owner’s operational needs.

BUILDING ENERGY EFFICIENCY STANDARDS - California Code of Regulations (California Code of Regulations), Title 24, Part 2, Chapter 2-53; regulating the energy efficiency of buildings constructed in California.

BUILDING ENERGY SIMULATION MODEL - Computer models based on physical engineering principals and/or standards used to estimate energy usage and/or savings. These models do not make use of billing or metered data, but usually incorporate site-specific data on customers and physical systems. Building Simulation Models usually require such site-specific data as square footage, weather, surface orientations, elevations, space volumes, construction materials, equipment use, lighting and building occupancy. Building simulation models can usually account for interactive effects between end uses (e.g., lighting and HVAC), part-load efficiencies, and changes in external and internal

heat gains/losses. Examples of building simulation models include ADM2, BLAST, and DOE-2.

BUILDING ENVELOPE - The assembly of exterior partitions of a building which enclose conditioned spaces, through which thermal energy may be transferred to or from the exterior, unconditioned spaces, or the ground. [See California Code of Regulations, Title 24, Section 2-5302]

CADMAC - See CALIFORNIA DEMAND-SIDE MANAGEMENT MEASUREMENT ADVISORY COUNCIL.

CALIFORNIA CONSUMER POWER AND CONSERVATION FINANCING AUTHORITY (CPA) - The state agency charged with the responsibility to ensure sufficient electricity at reasonable market prices.

CALIFORNIA MEASUREMENT ADVISORY COUNCIL (CALMAC) - An informal committee made up of utility representatives, the California Public Utilities Commission, the California Energy Commission, and the Natural Resources Defense Council. CALMAC provides a forum for the development, implementation, presentation, discussion, and review of regional and statewide market assessment and evaluation studies for California energy efficiency programs conducted by member organizations using Public Goods Charge funds.

CALIFORNIA DEMAND-SIDE MANAGEMENT MEASUREMENT ADVISORY COUNCIL (CADMAC) - An informal committee made up of utility representatives, the Office of Ratepayer Advocates and the California Energy Commission. The purpose of the committee is to: provide a forum for presentations, discussions, and review of Demand Side Management (DSM) program measurement studies underway or completed; to coordinate the development and implementation of measurement studies common to all or most of the utilities; and to facilitate the development of effective, state-of-the-art protocols for measuring and evaluating the impacts of DSM programs.

CALIFORNIA ENERGY COMMISSION (CEC) - The state agency established by the Warren-Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) responsible for energy policy. Funding for the Commission's activities comes from the Energy Resources Program Account, Federal Petroleum Violation Escrow Account and other sources. The CEC has statewide power plant siting, supply and demand forecasting, as well as multiple types of energy policy and analysis responsibilities.

CALIFORNIA PUBLIC UTILITIES COMMISSION (CPUC) - A state agency created by constitutional amendment in 1911 to regulate the rates and services of more than 1,500 privately owned utilities and 20,000 transportation companies. The CPUC is an administrative agency that exercises both legislative and judicial powers; its decisions and orders may be appealed only to the California Supreme Court. The major duties of the CPUC are to regulate privately owned utilities, securing adequate service to the

public at rates that are just and reasonable both to customers and shareholders of the utilities; including rates, electricity transmission lines and natural gas pipelines. The CPUC also provides electricity and natural gas forecasting, and analysis and planning of energy supply and resources. Its main headquarters are in San Francisco.

CALIFORNIA UTILITY RESEARCH COUNCIL (CURC) - Public Utilities Code, Sections 9201-9203 requires the California Energy Commission, the California Public Utilities Commission, and the investor-owned utilities (Pacific Gas and Electric Company, Southern California Edison, and San Diego Gas & Electric) to coordinate and promote consistency of research, development and demonstration (RD&D) programs with state energy policy. The CURC provides coordination for and sharing of information on energy RD&D in California to avoid duplication of efforts.

CALMAC – See **CALIFORNIA MANAGEMENT MEASUREMENT ADVISORY COUNCIL**.

CAPACITY - The amount of electric power for which a generating unit, generating station, or other electrical apparatus is rated either by the user or manufacturer. The term is also used for the total volume of natural gas that can flow through a pipeline over a given amount of time, considering such factors as compression and pipeline size.

CAPACITY FACTOR - A percentage that tells how much of a power plant's capacity is used over time. For example, typical plant capacity factors range as high as 80 percent for geothermal and 70 percent for cogeneration.

CAULKING - Material used to make an air-tight seal by filling in cracks, such as those around windows and doors.

CCR - California Code of Regulations.

CEC - See **CALIFORNIA ENERGY COMMISSION**.

CFCs (CHLOROFLUOROCARBONS or CHLORINATED FLUOROCARBONS) - A family of artificially produced chemicals receiving much attention for their role in stratospheric ozone depletion. On a per molecule basis, these chemicals are several thousand times more effective as greenhouse gases than carbon dioxide. Since they were introduced in the mid-1930s, CFCs have been used as refrigerants, solvents and in the production of foam material.

CFM (cubic feet per minute) - A measure of flow rate.

CHANGE MODEL - A type of billing analysis designed to explain changes in energy usage. This can take the form of having the change in energy consumption (pre versus post) as the dependent variable (e.g., December pre-retrofit usage – December post-retrofit usage), or having consumption as the dependent variable and pre-retrofit consumption as one of the independent variables.

COEFFICIENT OF PERFORMANCE (COP) COOLING - The ratio of the rate of heat removal to the rate of energy input in consistent units, for a complete cooling system or factory assembled equipment, as tested under a nationally recognized standard or designated operating conditions.

COEFFICIENT OF PERFORMANCE (COP) HEATING & HEAT PUMPS - Heating: the ratio of the rate of heat delivered to the rate of energy input, in consistent units, for a complete heat pump system under designated operating conditions. Supplemental heat shall not be considered when checking compliance with the heat pump equipment COPs.

COINCIDENT DEMAND - The metered demand of a device, circuit, or building that occurs at the same time as the peak demand of the building or facility or at the same time as some other peak of interest, such as a utility's system load. This should properly be expressed so as to indicate the peak of interest, e.g., "demand coincident with the building peak."

COMFORT CONDITIONING - The process of treating air to simultaneously control its temperature, humidity, cleanliness, and distribution to meet the comfort requirements of the occupants of the conditioned space.

COMFORT ZONE - The range of temperatures over which the majority of persons feel comfortable (neither too hot nor too cold).

COMMERCIALIZATION - Programs or activities that increase the value or decrease the cost of integrating new products or services into the electricity sector.

COMPARISON GROUP - A group of customers who did not participate during the program year and who share as many characteristics as possible with the participant group.

COMPREHENSIVE - A program or project designed to achieve all cost-effective energy efficiency activities in individual buildings, usually including multiple energy efficiency measures.

CONDITIONAL DEMAND ANALYSIS (CDA) - A type of billing analysis in which observed energy consumption is estimated as a function of major end uses, often portrayed as dummy variables for their existence at the customer residence/facility.

CONDITIONED FLOOR AREA - The floor area of enclosed conditioned spaces on all floors measured from the interior surfaces of exterior partitions for non-residential buildings and from the exterior surfaces of exterior partitions for residential buildings. [See California Code of Regulations, Title 24, Section 2-5302]

CONDITIONED SPACE - Enclosed space that is either directly conditioned space or indirectly conditioned space. [See California Code of Regulations, Title 24, Section 2-5302]

CONDITIONED SPACE, DIRECTLY - An enclosed space that is provided with heating equipment that has a capacity exceeding 10 Btus/(hr-ft²), or with cooling equipment that has a capacity exceeding 10 Btus/(hr-ft²). An exception is if the heating and cooling equipment is designed and thermostatically controlled to maintain a process environment temperature less than 65 degrees Fahrenheit or greater than 85 degrees Fahrenheit for the whole space the equipment serves. [See California Code of Regulations, Title 24, Section 2- 5302]

CONDITIONED SPACE, INDIRECTLY - Enclosed space that: (1) has a greater area weighted heat transfer coefficient (u-value) between it and directly conditioned spaces than between it and the outdoors or unconditioned space; (2) has air transferred from directly conditioned space moving through it at a rate exceeding three air changes per hour.

CONSERVATION - Steps taken to cause less energy to be used than would otherwise be the case. These steps may involve improved efficiency, avoidance of waste, reduced consumption, etc. They may involve installing equipment (such as a computer to ensure efficient energy use), modifying equipment (such as making a boiler more efficient), adding insulation, changing behavior patterns, etc.

CONSTRUCT VALIDITY - The extent to which an operating variable/instrument accurately taps an underlying concept/hypothesis, properly measuring an abstract quality or idea.

CONTENT VALIDITY - The extent to which an operating measure taps all the separate sub-concepts of a complicated concept.

CONTINGENCY PLANNING - The Energy Commission's strategy to respond to impending energy emergencies such as curtailment or shortage of fuel or power because of natural disasters or the result of human or political causes, or a clear threat to public health, safety or welfare. The contingency plan specifies state actions to alleviate the impacts of a possible shortage or disruption of petroleum, natural gas or electricity. The plan is reviewed and updated at least every five years, with the last plan being adopted in 1993. Legislative authority for the California Energy Shortage Contingency Plan is found in Public Resources Code, Section 25216.5.

CONTRACT DEMAND - The maximum demand, which may or may not be metered, that is expected or allowed under the contract with the utility providing the energy.

CONVERGENT VALIDITY - When two instruments/questions/measurement methods obtain similar results when measuring the same underlying construct with varying questions/approaches.

CONVERSION FUEL FACTOR - A number stating units of one system in corresponding values of another system.

COOLING CAPACITY, TOTAL - Available refrigerating capacity of an air conditioner for removing sensible heat and latent heat from the space to be conditioned.

COOLING DEGREE DAYS - The cumulative number of degrees in a month or year by which the mean temperature is above 18.3°C/65°F.

COOLING LOAD - The rate at which heat must be extracted from a space in order to maintain the desired temperature within the space.

COOLING LOAD TEMPERATURE DIFFERENCE (CLTD) - A value used in cooling load calculations for the effective temperature difference (delta T) across a wall or ceiling, which accounts for the effect of radiant heat as well as the temperature difference.

COP - See COEFFICIENT OF PERFORMANCE.

CORRELATION COEFFICIENT - A measure of the linear association between two variables, calculated as the square root of the R^2 obtained by regressing one variable on the other and signed to indicate whether the relationship is positive or negative.

COST-EFFECTIVENESS - An indicator of the relative performance or economic attractiveness of any energy efficiency investment or practice when compared to the costs of energy produced and delivered in the absence of such an investment. In the energy efficiency field, the present value of the estimated benefits produced by an energy efficiency program as compared to the estimated total program's costs, from the perspective of either society as a whole or of individual customers, to determine if the proposed investment or measure is desirable from a variety of perspectives, e.g., whether the estimated benefits exceed the estimated costs. See TOTAL RESOURCE COST TEST – SOCIETAL VERSION and PARTICIPANT COST TEST.

CPA - See CALIFORNIA CONSUMER POWER AND CONSERVATION FINANCING AUTHORITY.

CPUC - See CALIFORNIA PUBLIC UTILITIES COMMISSION.

CREAM SKIMMING - Cream skimming results in the pursuit of only the lowest cost or most cost-effective energy efficiency measures, leaving behind other cost-effective opportunities. Cream skimming is inappropriate when lost opportunities are created in the process.

CROSS-CUTTING PROGRAM - A program that involves any or all of the following: multiple customer types (residential and/or non-residential), and/or multiple building types (retrofit, remodeling, and/or new construction).

CUBIC FOOT - The most common unit of measurement of natural gas volume. It equals the amount of gas required to fill a volume of one cubic foot under stated conditions of

temperature, pressure and water vapor. One cubic foot of natural gas has an energy content of approximately 1,000 Btus. One hundred (100) cubic feet equals one therm (100 ft³ = 1 therm).

CURC - See CALIFORNIA UTILITY RESEARCH COUNCIL.

CUSTOMER - Any person or entity that pays an electric and/or gas bill to an IOU and that is the ultimate consumer of goods and services including energy efficiency products, services, or practices.

CUSTOMER INFORMATION - Non-public information and data specific to a Utility Customer which the utility acquired or developed in the course of its provision of Utility Services.

DAYLIGHTING - The use of sunlight to supplement or replace electric lighting.

DEFAULT ASSUMPTION - The value of an input used in a calculation procedure when a value is not entered by the designer.

DELTA - Difference in temperature. Often used in the context of the difference between the design indoor temperature and the outdoor temperature.

DEMAND - The time rate of energy flow. Demand usually refers to electric power and is measured in kW (equals kWh/h) but can also refer to natural gas, usually as Btu/hr, kBtu/hr, therms/day or ccf/day.

DEMAND (Utility) - The level at which electricity or natural gas is delivered to users at a given point in time. Electric demand is expressed in kilowatts.

DEMAND BILLING - The electric capacity requirement for which a large user pays. It may be based on the customer's peak demand during the contract year, on a previous maximum or on an agreed minimum. Measured in kilowatts.

DEMAND CHARGE - The sum to be paid by a large electricity consumer for its peak usage level.

DEMAND RESPONSIVENESS - Also sometimes referred to as load shifting. Activities or equipment that induce consumers to use energy at different (lower cost) times of day or to interrupt energy use for certain equipment temporarily, usually in direct response to a price signal. Examples: interruptible rates, doing laundry after 7 p.m., air conditioner recycling programs.

DEMAND SAVINGS - The reduction in the demand from the pre-retrofit baseline to the post-retrofit demand, once independent variables (such as weather or occupancy) have been adjusted for. This term is usually applied to billing demand, to calculate cost savings, or to peak demand, for equipment sizing purposes.

DEMAND SIDE MANAGEMENT (DSM) - The methods used to manage energy demand including energy efficiency, load management, fuel substitution and load building. See **LOAD MANAGEMENT**.

DEMONSTRATION - The application and integration of a new product or service into an existing or new system. Most commonly, demonstration involves the construction and operation of a new electric technology interconnected with the electric utility system to demonstrate how it interacts with the system. This includes the impacts the technology may have on the system and the impacts that the larger utility system might have on the functioning of the technology.

DESIGN ASSISTANCE - These programs provide design and analysis services to the architects and engineers responsible for the design of new residential and commercial buildings. The goal of these programs is to make the building more energy efficient.

DESIGNATED UNIT(S) OF MEASUREMENT - The metric(s) used for expressing load impacts for a particular program as a function of customer characteristics (e.g., kWh per square foot). The metric is used to compare load impacts of different customers or customer groups (participants, comparison group samples, future participants).

DIRECT INSTALLATION PROGRAMS - These types of programs provide free energy efficiency measures for qualified customers. Typical measures distributed by these programs include low flow showerheads and compact fluorescent bulbs.

DIRECT SOLAR GAIN - Solar energy collected from the sun (as heat) in a building through windows, walls, skylights, etc.

DISTRIBUTED GENERATION - A distributed generation system involves small amounts of generation located on a utility's distribution system for the purpose of meeting local (substation level) peak loads and/or displacing the need to build additional (or upgrade) local distribution lines.

DOUBLE-BARRELED QUESTIONS - A poorly worded questionnaire item which actually asks two questions at the same time, thereby not allowing unique and accurate interpretation of the results.

DOUBLE GLAZING - Windows having two sheets of glass with an airspace between.

DOUBLE DIPPING - Taking advantage of multiple financial incentives offered by multiple programs for undertaking only one activity.

DRY BULB TEMPERATURE - A measure of the sensible temperature of air.

DSM - See **DEMAND SIDE MANAGEMENT**.

DUAL-PANED (double-glazed) - Two panes of glass or other transparent material, separated by a space.

ECONOMIC EFFICIENCY - A term that refers to the optimal production and consumption of goods and services. This generally occurs when prices of products and services reflect their marginal costs. Economic efficiency gains can be achieved through cost reduction, but it is better to think of the concept as actions that promote an increase in overall net value (which includes, but is not limited to, cost reductions).

ECONOMIC POTENTIAL - Refers to that part of the technical potential that can cost-effectively be obtained when compared to supply-side alternatives.

ECONOMIES OF SCALE - Economies of scale exist where the industry exhibits decreasing average long-run costs with size.

EDUCATION PROGRAMS - Programs primarily intended to educate customers about energy efficient technologies or behaviors or provide information about programs that offer energy efficiency or load reduction information or services.

EER - See ENERGY EFFICIENCY RATIO.

EFFECTIVE USEFUL LIFE (EUL) - An estimate of the median number of years that the measures installed under the program are still in place and operable.

EFFICACY, LIGHTING - The ratio of light from a lamp to the electrical power consumed, including ballast losses, expressed as lumens per watt. [See California Code of Regulations, Title 24, Section 2-5302]

EFFICIENCY - The ratio of the useful energy delivered by a dynamic system (such as a machine, engine, or motor) to the energy supplied to it over the same period or cycle of operation. The ratio is usually determined under specific test conditions.

ELECTRIC PUBLIC GOODS CHARGE (PGC) - Per Assembly Bill (AB) 1890, a universal charge applied to each electric utility Customer's bill to support the provision of public goods. Public goods covered by California's electric PGC include public purpose energy efficiency programs, low-income services, renewables, and energy-related research and development.

EMISSIVITY - The property of emitting radiation; possessed by all materials to a varying extent.

EMITTANCE - The emissivity of a material, expressed as a fraction. Emittance values range from 0.05 for brightly polished metals to 0.96 for flat black paint.

END USE (MEASURES/GROUPS) - Refers to a broad or sometimes narrower category that the program is concentrating efforts upon. Examples of end uses include: refrigeration, food service, HVAC, appliances, envelope and lighting.

ENERGY CONSUMPTION - The amount of energy consumed in the form in which it is acquired by the user. The term excludes electrical generation and distribution losses.

ENERGY COST - The total cost for energy, including such charges as base charges, demand charges, customer charges, power factor charges, and miscellaneous charges.

ENERGY (FUEL) DIVERSITY - policy that encourages the development of energy technologies to diversify energy supply sources, thus reducing reliance on conventional (petroleum) fuels; applies to all energy sectors.

ENERGY EFFICIENCY - Using less energy/electricity to perform the same function. Programs designed to use electricity more efficiently - doing the same with less. For the purpose of this paper, energy efficiency is distinguished from DSM programs in that the latter are utility-sponsored and -financed, while the former is a broader term not limited to any particular sponsor or funding source. "Energy conservation" is a term that has also been used but it has the connotation of doing without in order to save energy rather than using less energy to do the same thing and so is not used as much today. Many people use these terms interchangeably.

ENERGY EFFICIENCY IMPROVEMENT - Reduced energy use for a comparable level of service, resulting from the installation of an energy efficiency measure or the adoption of an energy efficiency practice. Level of service may be expressed in such ways as the volume of a refrigerator, temperature levels, production output of a manufacturing facility, or lighting level per square foot.

ENERGY EFFICIENCY MEASURE - Installation of equipment, subsystems, or systems, or modification of equipment, subsystems, systems, or operations, on the Customer side of the meter, for the purpose of reducing energy and/or demand (and, hence, energy and/or demand costs) at a comparable level of service.

ENERGY EFFICIENCY OF A MEASURE - A measure of the energy used to provide a specific service or to accomplish a specific amount of work (e.g., kWh per cubic foot of a refrigerator, therms per gallon of hot water).

ENERGY EFFICIENCY OF EQUIPMENT - The percentage of gross energy input that is realized as useful energy output of a piece of equipment.

ENERGY EFFICIENCY PRACTICE - The use of high-efficiency products, services, and practices or an energy-using appliance or piece of equipment, to reduce energy usage while maintaining a comparable level of service when installed or applied on the Customer side of the meter. Energy efficiency activities typically require permanent

replacement of energy-using equipment with more efficient models. Examples: refrigerator replacement, light fixture replacement, cooling equipment upgrades.

ENERGY EFFICIENCY RATIO (EER) - The ratio of cooling capacity of an air conditioning unit in Btus per hour to the total electrical input in watts under specified test conditions. [See California Code of Regulations, Title 20, Section 1602(c)(6)]

ENERGY MANAGEMENT SERVICES - Programs intended to provide customer assistance in the form of information on the relative costs and benefits to the customer of installing measures or adopting practices which can reduce the customer's utility bills. The information is solicited by the customer and recommendations are based on the customer's recent billing history and/or customer-specific information regarding appliance and building characteristics.

ENERGY MANAGEMENT SYSTEM - A control system (often computerized) designed to regulate the energy consumption of a building by controlling the operation of energy consuming systems, such as the heating, ventilation and air conditioning (HVAC), lighting and water heating systems.

ENERGY RESOURCES PROGRAM ACCOUNT (ERPA) - The state law that directs California electric utility companies to gather a state energy surcharge per kilowatt hour of electricity consumed by a customer. These funds are used for operation of the California Energy Commission. As of January 1, 2004, the surcharge is set at of three-tenths of one mil (\$0.0003) per kilowatt-hour.

ENERGY SAVINGS - The reduction in use of energy from the pre-retrofit baseline to the post-retrofit energy use, once independent variables (such as weather or occupancy) have been adjusted for.

ENERGY SERVICE COMPANY (ESCO) - An organization that designs, procures, installs, and possibly maintains one or more energy conservation measures (ECMs) at an owner's facility or facilities. Typically ESCOs offer to reduce a client's electricity consumption with the cost savings being split with the client.

ENGINEERING APPROACHES - Methods using engineering algorithms or models to estimate energy and/or demand use.

ENGINEERING USEFUL LIFE - An engineering estimate of the number of years that a piece of equipment will operate if properly maintained.

ERPA - See ENERGY RESOURCES PROGRAM ACCOUNT.

ERROR - Deviation of measurements from the true value.

ESCO - See ENERGY SERVICE COMPANY.

EUL - See EFFECTIVE USEFUL LIFE.

EVALUATION - The performance of studies and activities aimed at determining the effects of a program, or any of a wide range of assessment activities associated with understanding or documenting program performance or potential performance, assessing program or program-related markets and market operations, or any of a wide range of evaluative efforts including assessing program-induced changes in energy efficiency markets, levels of demand or energy savings, and program cost-effectiveness.

EXCEPTIONAL METHOD - An approved alternative calculation method that analyzes designs, materials, or devices that cannot be adequately modeled using public domain computer programs. Exceptional methods must be submitted to and approved by the California Energy Commission. [See California Code of Regulations, Title 20, Section 1409(b)3] Two examples of exceptional methods are the controlled ventilation crawl space (CVC) credit and the combined hydronic space and water heating method.

EXTERNAL VALIDITY - The extent to which the association between an independent variable and a dependent variable that is demonstrated within a research setting also holds true in the general environment.

FINANCING PROGRAMS - These types of programs encourage investments in energy efficiency through offerings such as: below market interest rates or terms, gap financing, and financial packages.

FOOTCANDLE - A unit of illuminance on a surface that is one foot from a uniform point source of light of one candle and is equal to one lumen per square foot.

FRAMING EFFECTS - The effect of framing (wood or metal studs, joists, beams, etc.) on the overall U-value of a wall, roof, floor, window or other building surface. Framing generally increases the U-Value and decreases the R-Value of insulated surfaces.

FREE DRIVER - A non-participant who adopted a particular efficiency measure or practice as a result of a utility program. See SPILLOVER EFFECTS for aggregate impacts.

FREE RIDER - A program participant who would have implemented the program measure or practice in the absence of the program.

GAS PUBLIC GOODS CHARGE - Created by AB1002 in 2000, an unbundled rate component included on gas customer bills to fund public purpose programs including energy efficiency, low-income and research and development.

GENERAL LIGHTING - Lighting designed to provide a substantially uniform level of illumination throughout an area, exclusive of any provision for special visual tasks or decorative effects. [See California Code of Regulations, Title 24, Section 2-5302]

GIGAWATT (GW) - One thousand megawatts (1,000 MW) or, one million kilowatts (1,000,000 kW) or one billion watts (1,000,000,000 watts) of electricity. One gigawatt is enough to supply the electric demand of about one million average California homes.

GIGAWATT-HOUR (GWH) - One million kilowatt-hours of electric power.

GLAZING - A covering of transparent or translucent material (typically glass or plastic) used for admitting light.

GLOBAL CLIMATE CHANGE - Gradual changing of global climates due to buildup of carbon dioxide and other greenhouse gases in the earth's atmosphere. Carbon dioxide produced by burning fossil fuels has reached levels greater than what can be absorbed by green plants and the seas.

GREENHOUSE EFFECT - The presence of trace atmospheric gases make the earth warmer than would direct sunlight alone. These gases (carbon dioxide [CO₂], methane [CH₄], nitrous oxide [N₂O], tropospheric ozone [O₃], and water vapor [H₂O]) allow visible light and ultraviolet light (shortwave radiation) to pass through the atmosphere and heat the earth's surface. This heat is re-radiated from the earth in form of infrared energy (long wave radiation). The greenhouse gases absorb part of that energy before it escapes into space. This process of trapping the long wave radiation is known as the greenhouse effect. Scientists estimate that without the greenhouse effect, the earth's surface would be roughly 54 degrees Fahrenheit colder than it is today - too cold to support life as we know it. See GLOBAL CLIMATE CHANGE.

GROSS AREA - The area of a surface including areas not belonging to that surface (such as windows and doors in a wall).

GROSS LOAD IMPACT - The change in energy consumption and/or demand that results directly from program-related actions taken by participants in the DSM program, regardless of why they participated.

HARDWARE PROGRAMS - Programs primarily intended to provide measurable energy savings through installation of energy efficiency measures or provision of energy efficiency services.

HEAT BALANCE - The outdoor temperature at which a building's internal heat gain (from people, lights and machines) is equal to the heat loss through windows, roof and walls.

HEAT CAPACITY - The amount of heat necessary to raise the temperature of a given mass one degree. Heat capacity may be calculated by multiplying the mass by the specific heat.

HEAT GAIN - an increase in the amount of heat contained in a space, resulting from direct solar radiation, heat flow through walls, windows, and other building surfaces, and the heat given off by people, lights, equipment, and other sources.

HEAT LOSS - A decrease in the amount of heat contained in a space, resulting from heat flow through walls, windows, roof and other building surfaces and from exfiltration of warm air.

HEAT PUMP - An air conditioning unit which is capable of heating by refrigeration, transferring heat from one (often cooler) medium to another (often warmer) medium, and which may or may not include a capability for cooling. This reverse-cycle air conditioner usually provides cooling in summer and heating in winter.

HEAT RATE - A number that tells how efficient a fuel-burning power plant is. The heat rate equals the Btu content of the fuel input divided by the kilowatt-hours of power output.

HEAT TRANSFER - Flow of heat energy induced by a temperature difference. Heat flow through a building envelope typically flows from a heated, or hot area to a cooled, or cold area.

HEATING DEGREE DAYS - The cumulative number of degrees in a month or year by which the mean temperature falls below 18.3°C/65°F.

HEAP - See HOME ENERGY ASSISTANCE PROGRAM.

HEATING SEASONAL PERFORMANCE FACTOR (HSPF) - A representation of the total heating output of a central air conditioning heat pump in Btus during its normal usage period for heating, divided by the total electrical energy input in watt-hours during the same period, as determined using the test procedure specified in the California Code of Regulations, Title 20, Section 1603(c).

HETEROSCEDASTICITY - The variance in the error term is changing. This violates the regression assumption of constant variance. Common example is where variance is expected to be greater on a variable measurement for larger firms than for smaller firms.

HOME ENERGY ASSISTANCE PROGRAM (HEAP) - A centrally operated direct payment program that assists eligible households in offsetting the cost of heating and cooling their homes. Payments are generally made in the form of dual party warrants (checks) made payable to the applicant and their designated utility company. The program is administered by the California Department of Economic Opportunity using federal and state funds.

HOMOSCEDASTIC (HOMOSCEDASTICITY) - The error term has constant variance, an assumption of classical regression analysis.

HORSEPOWER (HP) - A unit for measuring the rate of doing work. One horsepower equals about three-fourths of a kilowatt (745.7 watts).

HSPF - See HEATING SEASONAL PERFORMANCE FACTOR.

HVAC (Heating Ventilation and Air Conditioning) - A system that provides heating, ventilation and/or cooling within or associated with a building.

HVAC SYSTEM - The equipment, distribution network, and terminals that provides either collectively or individually the processes of heating, ventilating, or air conditioning to a building.

JACK-KNIFE - A means of estimating a statistical/econometric estimator's variance by computing the variance of the estimates produced by that estimator omitting each of the observations in turn.

IMPACT EVALUATION - Used to measure the change in energy and/or demand usage (such kWh, kW and therms) attributed to energy efficiency and demand response programs.

IMPACT YEAR - Depending on the context, impact year means either (a) the twelve months subsequent to participation used to represent program costs or load impacts occurring in that year, or (b) any calendar year after the program year in which load impacts may occur.

IMPLEMENTATION THEORY - A theory describing how a program should be structured and implemented and the theoretical rationale supporting the reasons for the program structure and the implementation approach.

IMPLEMENTER - An entity or person selected and contracted with or qualified by a program administrator or by the Commission to receive PGC funds for providing products and services to customers.

INCENTIVES - Financial support (e.g., rebates, low-interest loans) to install energy efficiency measures. The incentives are solicited by the customer and based on the customer's billing history and/or customer-specific information.

INDEPENDENT VARIABLES - The factors that affect the energy and demand used in a building but cannot be controlled (e.g., weather or occupancy).

INDIGENOUS ENERGY RESOURCES - Power and heat derived from sources native to California. These include geothermal, hydro, biomass, solar and wind energy. The term usually is understood to include cogeneration facilities.

INFILTRATION - The uncontrolled inward leakage of air through cracks and gaps in the building envelope, especially around windows, doors and duct systems.

INFILTRATION BARRIER - A material placed on the outside or the inside of exterior wall framing to restrict inward air leakage, while permitting the outward escape of water vapor from the wall cavity. [See California Code of Regulations, Title 24, Section 2-5302]

INFORMATION PROGRAMS - Programs primarily intended to provide customers with information regarding generic (not customer-specific) conservation and energy efficiency opportunities. For these programs, the information may be unsolicited by the customer. Programs that provide incentives in the form of unsolicited coupons for discount on low cost measures are also included.

INSULATION, THERMAL - A material having a relatively high resistance of heat flow and used principally to retard heat flow. See R-VALUE.

INTEGRATED PART-LOAD VALUE (IPLV) - A single number figure of merit based on part-load EER or COP expressing part-load efficiency for air conditioning and heat pump equipment on the basis of weighted operation at various load capacities for the equipment.

INTEGRATED RESOURCE PLANNING (IRP) - A public planning process and framework within which the costs and benefits of both demand- and supply-side resources are evaluated to develop the least-total-cost mix of utility resource options. In many states, IRP includes a means for considering environmental damages caused by electricity supply/transmission and identifying cost-effective energy efficiency and renewable energy alternatives. IRP has become a formal process prescribed by law in some states and under some provisions of the Clean Air Act amendments of 1992.

INTERNAL VALIDITY - The extent to which alternative explanations can be eliminated as causes for an observed association between an independent and dependent variables within a research setting/sample.

INTERRUPTIBLE SERVICE (Electric utility) - Electricity supplied under agreements that allow the supplier to curtail or stop service at times.

INVESTOR-OWNED UTILITIES (IOU) - A private company that provides a utility, such as water, natural gas or electricity, to a specific service area. The investor-owned utility is regulated by the California Public Utilities Commission.

JOULE - A unit of work or energy equal to the amount of work done when the point of application of force of 1 newton is displaced 1 meter in the direction of the force. It takes 1,055 joules to equal a British thermal unit. It takes about 1 million joules to make a pot of coffee.

kBtu - One-thousand (1,000) Btus.

KILOWATT (kW) - One thousand (1,000) watts. A unit of measure of the amount of electricity needed to operate given equipment. On a hot summer afternoon a typical home with central air conditioning and other equipment in use might have a demand of four kW each hour.

KILOWATT-HOUR (kWh) - The most commonly-used unit of measure telling the amount of electricity consumed over time. It means one kilowatt of electricity supplied for one hour.

LATENT HEAT - A change in the heat content that occurs without a corresponding change in temperature, usually accompanied by a change of state (as from liquid to vapor during evaporation).

LATENT LOAD - The cooling load caused by moisture in the air.

LEVEL OF SERVICES - The utility received by a customer from energy using equipment. Level of service may be expressed as the volume of a refrigerator, an indoor temperature level, the production output of a manufacturing facility, lighting levels per square foot, etc.

LIFE EXTENSION - A term used to describe capital expenses which reduce operating and maintenance costs associated with continued operation of electric utility boilers. Such boilers usually have a forty-year operating life under normal circumstances.

LIFE-CYCLE COST - Amount of money necessary to own, operate and maintain a building over its useful life.

LIFELINE RATES - Rates charged by a utility company for the low income, the disadvantaged and senior citizens. The rates provide a discount for minimum necessary utilities, such as electricity requirements of typically 300 to 400 kilowatt/hours per month.

LINEAR REGRESSION ESTIMATOR (FOR SAMPLING) - Used to increase precision in a sample design by using an auxiliary variable that is correlated with the desired outcome variable where the relationship line does not go through the origin (as would be the case for a ratio estimator). Either a uniform regression estimator across strata or separate regression estimators per strata may be selected as the best design based upon the whether there is a relationship between the auxiliary variable and the selection of the strata parameter.

LIRM - See **LOAD IMPACT REGRESSION MODEL**.

LOAD - An end use device or an end use customer that consumes power. Load should not be confused with demand, which is the measure of power that a load receives or requires. The amount of electric power supplied to meet one or more end user's needs.

LOAD DIVERSITY - The condition that exists when the peak demands of a variety of electric customers occur at different times. This is the objective of “load molding” strategies, ultimately curbing the total capacity requirements of a utility.

LOAD FACTOR - A percent telling the difference between the amount of electricity a consumer used during a given time span and the amount that would have been used if the usage had stayed at the consumer’s highest demand level during the whole time. The term also is used to mean the percentage of capacity of an energy facility - such as power plant or gas pipeline - that is utilized in a given period of time.

LOAD IMPACT - Changes in electric energy use, electric peak demand, or natural gas use.

LOAD IMPACT REGRESSION MODEL (LIRM) - The most general definition of a LIRM is a statistical model that produces estimates of the load impacts of energy conservation programs. Depending on the particular approach and the statistical issues encountered, it may involve more than one regression model and technique: (1) The load impact estimation model typically is a linear or non-linear regression model that uses billing data that estimates gross and/or net load impacts. Data from program non-participants, in addition to participant data, can be used to derive net impacts directly or to affect other statistical control. (2) The participant/decision model typically is a discrete choice model used in conjunction with the load impact estimation model to isolate free ridership effects, generate self-selection correction terms, and/or net-to-gross ratios as needed. When this model is used to estimate a net-to-gross ratio, the resulting estimate is multiplied by an estimate of gross load impact to yield an estimate of net load impact.

LOAD MANAGEMENT - Steps taken to reduce power demand at peak load times or to shift some of it to off-peak times. This may be with reference to peak hours, peak days or peak seasons. The main thing affecting electric peaks is air conditioning usage, which is therefore a prime target for load management efforts. Load management may be pursued by persuading consumers to modify behavior or by using equipment that regulates some electric consumption.

LOAD PROGRAM - A program that provides services to customers in only one jurisdiction of the state (e.g., one county, city, or region). Local programs may be experimental and are designed to serve the needs of a particular geographic area.

LOAD SHAPE - The time-of-use pattern of customer or equipment energy use. This pattern can be over 24 hours or over a year (8760 hours).

LOAD SHAPE IMPACTS - Changes in load shape induced by a program.

LOADED QUESTION - A question whose wording encourages the respondent to provide a particular answer.

LOGIC MODEL - The graphical representation of the program theory showing the flow between activities, their outputs, and subsequent short-term, intermediate, and long-term outcomes. Often the logic model is displayed with these elements in boxes and the causal flow being shown by arrows from one to the others in the program logic. It can also be displayed as a table with the linear relationship presented by the rows in the table.

LOSSES (Electric utility) - Electric energy or capacity that is wasted in the normal operation of a power system. Some kilowatt-hours are lost in the form of waste heat in electrical apparatus such as substation conductors. **LINE LOSSES** are kilowatts or kilowatt-hours lost in transmission and distribution lines under certain conditions.

LOST OPPORTUNITIES - Energy efficiency measures that offer long-lived, cost-effective savings that are fleeting in nature. A lost opportunity occurs when a customer does not install an energy efficiency measure that is cost-effective at the time, but whose installation is unlikely to be cost-effective (or is less cost-effective) later.

LOW-E - A special coating that reduces the emissivity of a window assembly, thereby reducing the heat transfer through the assembly.

LUMEN - A measure of the amount of light available from a light source equivalent to the light emitted by one candle.

LUMENS/WATT - A measure of the efficacy of a light fixture; the number of lumens output per watt of power consumed.

LUMINAIRE - A complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps and to connect the lamps to the power supply. California Code of Regulations, Section 2- 1602(h)].

LUX - A unit of illumination equal to the direct illumination on a surface that is everywhere one meter from a uniform point source of one candle; a unit of illumination that is equal to one lumen per square meter.

MAIN METER - The meter that measures the energy used for the whole facility. There is at least one meter for each energy source and possibly more than one per source for large facilities. Typically, utility meters are used, but dataloggers may also be used as long as they isolate the load for the facility being studied. When more than one meter per energy source exists for a facility, the main meter may be considered the accumulation of all the meters involved.

MARGINAL COST - The sum that has to be paid for the next increment of product or service. The marginal cost of electricity is the price to be paid for kilowatt-hours above and beyond those supplied by presently available generating capacity.

MARKET ACTORS - Individuals and organizations in the production, distribution, and/or delivery chain of energy efficiency products, services and practices. This may

include, but is not limited to, manufacturers, distributors, wholesalers, retailers, vendors, dealers, contractors, developers, builders, financial institutions, and real estate brokers and agents.

MARKET ASSESSMENT - An analysis function that provides an assessment of how and how well a specific market or market segment is functioning with respect to the definition of well-functioning markets or with respect to other specific policy objectives. Generally includes a characterization or description of the specific market or market segments, including a description of the types and number of buyers and sellers in the market, the key actors that influence the market, the type and number of transactions that occur on an annual basis, and the extent to which energy efficiency is considered an important part of these transactions by market participants. This analysis may also include an assessment of whether or not a market has been sufficiently transformed to justify a reduction or elimination of specific program interventions. Market assessment can be blended with strategic planning analysis to produce recommended program designs or budgets. One particular kind of market assessment effort is a baseline study, or the characterization of a market before the commencement of a specific intervention in the market, for the purpose of guiding the intervention and/or assessing its effectiveness later.

MARKET BARRIER - Any characteristic of the market for an energy-related product, service, or practice that helps to explain the gap between the actual level of investment in, or practice of, energy efficiency and an increased level that would appear to be cost-beneficial to the consumer.

MARKET EFFECT - A change in the structure or functioning of a market or the behavior of participants in a market that result from one or more program efforts. Typically these efforts are designed to increase in the adoption of energy efficient products, services, or practices and are causally related to market interventions.

MARKET EVENT - The broader circumstances under which a customer considers adopting an energy efficiency product, service, or practice. Types of market events include, but are not necessarily limited to, the following: (a) new construction, or the construction of a new building or facility; (b) renovation, or the updating of an existing building or facility; (c) remodeling, or a change in an existing building; (d) replacement, or the replacement of equipment, either as a result of an emergency such as equipment failure, or as part of a broader planned event; and, (e) retrofit, or the early replacement of equipment or refitting of a building or facility while equipment is still functioning, often as a result of an intervention into energy efficiency markets.

MARKET PARTICIPANTS - The individuals and organizations participating in transactions with one another within an energy efficiency market or markets, including Customers and Market Actors.

MARKET POTENTIAL STUDIES - See **ACHIEVABLE POTENTIAL**

MARKET SECTORS - General types of markets that a program may target or in which a service offering may be placed. Market sectors include categories such as Agricultural, Commercial, Industrial, Government, and Institutional. Market sectors help the Commission assess how well its portfolio of programs is addressing the variety of markets for energy efficiency products and services in the state.

MARKET SEGMENTS - A part of a market sector that can be grouped together as a result of a characteristic similar to the group. Within the residential sector are market segments, such as renters, owners, multi-family, single-family, etc. These market segments help the Commission assess how well its portfolio of programs is addressing the variety of segments within the markets served.

MARKET THEORY - A theoretical description of how a market operates relative to a specific program or set of programs designed to influence that market. Market theories typically include the identification of key market actors, information flows, and product flows through the market, relative to a program designed to change the way the market operates. Market theories are typically grounded upon the information provided from a market assessment but can also be based up other information. Market theories often describe how a program intervention can take advantage of the structure and function of a market to transform the market. Market theories can also describe the key barriers and benefits associated with a market and describe how a program can exploit the benefits and overcome the barriers.

MARKET TRANSFORMATION - A reduction in market barriers resulting from a market intervention, as evidenced by a set of market effects, that lasts after the intervention has been withdrawn, reduced or changed.

MARKET-BASED PRICE - A price set by the mutual decisions of many buyers and sellers in a competitive market.

MCF - One thousand cubic feet of natural gas, having an energy value of one million Btu. A typical home might use six MCF in a month.

MEASURE (noun) - A product whose installation and operation at a customer's premises results in a reduction in the customer's on-site energy use, compared to what would have happened otherwise. See also **ENERGY EFFICIENCY MEASURE**.

MEASURE (verb) - Use of an instrument to assess a physical quantity, or use of a computer simulation to estimate a physical quantity.

MEASURE DATA - Data collected from participants in a utility efficiency program after their participation.

MEASURE RETENTION STUDY - An assessment of (a) the length of time the measure(s) installed during the program year are maintained in operating condition; and

(b) the extent to which there has been a significant reduction in the effectiveness of the measure(s).

MEASURED SAVINGS - Savings or reductions in billing determinants, which are determined using engineering analysis in combination with measured data or through billing analysis.

MEGAWATT (MW) - One thousand kilowatts (1,000 kW) or one million (1,000,000) watts. One megawatt is enough energy to power 1,000 average California homes.

MEGAWATT HOUR (MWh) - One thousand kilowatt-hours, or an amount of electricity that would supply the monthly power needs of 1,000 typical homes in the Western U.S. (This is a rounding up to 8,760 kWh/year per home based on an average of 8,549 kWh used per household per year [U.S. DOE EIA, 1997 annual per capita electricity consumption figures].)

MESSAGE DILUTION FACTOR - The percent of a target market that is actually exposed to a message. A newspaper ad may reach two million people, but it may have a message dilution factor of .01 indicating that the message was actually seen by 20,000 people ($2,000,000 \times .01 = 20,000$).

METER - A device used to measure some quantity, which includes electrical demand, electrical energy, temperature, flow, and so on. A device for measuring levels and volumes of a customer's gas or electricity use.

METERED DATA - Data collected at a customer's premises over time through a meter for a specific end use, or energy-using system (e.g., lighting and HVAC), or location (e.g., floors of a building or a whole premise). Metered data may be collected over a variety of time intervals. Usually refers to electricity or gas data.

METERED DEMAND - The average time rate of energy flow over a period of time recorded by a utility meter.

METERING - The collection of energy consumption data over time at a customer's premises through the use of meters. These meters may collect information about kWh, kW or therms, with respect to an end use, a circuit, a piece or equipment or a whole building (or facility). Short-term metering generally refers to data collection for no more than a few weeks. End use metering refers specifically to separate data collection for one or more end uses in a building, such as lighting, air conditioning or refrigeration. What is called "spot metering" is not metering in this sense, but is instantaneous measurement (rather than over time) of volts, amps, watts or power factor to determine equipment size and/or power draw.

MODEL - A mathematical representation or calculation procedure that is used to predict the energy use and demand in a building or facility or to estimate efficiency program

savings estimates. Models may be based on equations that specifically represent the physical processes or may be the result of statistical analysis of energy use data.

MONITORING (equipment or system) - Gathering of relevant measurement data over time to evaluate equipment or system performance, e.g., chiller electric demand, inlet evaporator temperature and flow, outlet evaporator temperature, condenser inlet temperature, and ambient dry-bulb temperature and relative humidity or wet-bulb temperature, for use in developing a chiller performance map (e.g., kW/ton vs. cooling load and vs. condenser inlet temperature).

MULTICOLLINEARITY - When two or more independent variables in a regression model are highly correlated with each other producing high standard errors for the regression parameter. The mathematics of a regression model fail if there is perfect collinearity, an exact linear relationship between two or more independent variables. If the correlation between independent variables is higher than either has with the dependent variable, the problems of multicollinearity are highly likely.

NATURAL CHANGE - The change in base usage over time. Natural change represents the effects of energy-related decisions that would have been made in the absence of the utility programs by both program participants and non-participants.

NEES (or NEBS) - See NON-ENERGY EFFECTS.

NET LOAD IMPACT - The total change in load that is attributable to the utility DSM program. This change in load may include, implicitly or explicitly, the effects of free drivers, free riders, state or federal energy efficiency standards, changes in the level of energy service, and natural change effects.

NET-TO-GROSS RATIO - A factor representing net program load impacts divided by gross program load impacts that is applied to gross program load impacts to convert them into net program load impacts. This factor is also sometimes used to convert gross measure costs to net measure costs.

NEW CONSTRUCTION - Residential and non-residential buildings that have been newly built or have added major additions subject to Title 24, the California building standards code.

NON-DEPLETABLE ENERGY SOURCES - Energy that is not obtained from depletable energy sources. [See California Code of Regulations, Title 24, Section 2-5302]

NON-ENERGY EFFECTS (NEES) or NON-ENERGY BENEFITS (NEBS) – The identifiable and sometimes quantifiable non-energy results associated with program implementation or participation. Some examples of NEEs include: reduced emissions & environmental benefits, productivity improvements, jobs created, reduced utility debt and disconnects, and higher comfort and convenience level of participant. The effects of an energy efficiency or resource acquisition program that are other than energy saved.

NON-PARTICIPANT - Any customer who was eligible but did not participate in the utility program under consideration in a given program year.

NON-RESIDENTIAL - Facilities used for business, commercial, agricultural, institutional, and industrial purposes.

NON-RESIDENTIAL BUILDING - Any building which is heated or cooled in its interior, and is of an occupancy type other than Type H, I, or J, as defined in the Uniform Building Code, 1973 edition, as adopted by the International Conference of Building Officials.

NON-RESIDENTIAL HARD TO REACH - Those customers who do not have easy access to program information or generally do not participate in energy efficiency programs due to a language, business size, geographic, or lease (split incentive) barrier.

NORMALIZATION - Adjustment of the results of a model due to changes in baseline assumptions (non-independent variables) during the test or post-retrofit period.

NO_x - Oxides of nitrogen that are a chief component of air pollution that can be produced by the burning of fossil fuels. Also called nitrogen oxides.

NUG - A non-utility generator. A generation facility owned and operated by an entity who is not defined as a utility in that jurisdictional area.

OBLIGATION TO SERVE - The obligation of a utility to provide electric service to any customer who seeks that service, and is willing to pay the rates set for that service. Traditionally, utilities have assumed the obligation to serve in return for an exclusive monopoly franchise.

OCCUPANCY SENSOR - A control device that senses the presence of a person in a given space, commonly used to control lighting systems in buildings.

OHM - A unit of measure of electrical resistance. One volt can produce a current of one ampere through a resistance of one ohm.

ORIENTATION - The position of a building relative to the points of a compass.

OVERARCHING EVALUATION STUDIES - Collection and analysis of information at a statewide or regional level that can be used for program and portfolio evaluation planning and policy decision-making purposes.

PARALLEL SURVEY DESIGN - A survey in which similar questions on the same topic are asked to several distinct groups to assess construct validity.

PARTICIPANT - An individual, household, business, or other utility customer that received the service or financial assistance offered through a particular utility DSM program, set of utility programs, or particular aspect of a utility program in a given program year. Participation is determined in the same way as reported by a utility in its Annual DSM Summary.

PARTICIPANT TEST - A cost-effectiveness test intended to measure the cost-effectiveness of energy efficiency programs from the perspective of electric and/or gas customers (individuals or organizations) participating in them.

PARTIES OR INTERESTED PARTIES - Persons and organizations with an interest in energy efficiency that comment on or participate in the Commission's efforts to develop and implement ratepayer-funded energy efficiency programs.

PASSIVE SOLAR ENERGY - Use of the sun to help meet a building's energy needs by means of architectural design (such as arrangement of windows) and materials (such as floors that store heat).

PASSIVE SOLAR SYSTEM - A solar heating or cooling system that uses no external mechanical power to move the collected solar heat.

PBR - See PERFORMANCE-BASED REGULATION.

PEAK DEMAND - The maximum level of metered demand during a specified period, such as a billing month, or during a specified peak demand period.

PEAK DEMAND PERIOD - Noon to 7 p.m. Monday through Friday, June, July, August, and September.

PEAK LOAD - The highest electrical demand within a particular period of time. Daily electric peaks on weekdays occur in late afternoon and early evening. Annual peaks occur on hot summer days.

PERFORMANCE CONTRACTS - A binding agreement between two parties prescribing the range and magnitude of achievement required of equipment, subsystem, or system, which is provided by one party for the benefit and use of the other.

PERFORMANCE MANAGEMENT - The determination or the extent to which a person, organization, or program is successfully meeting specified goals and objectives.

PERFORMANCE-BASED REGULATION (PBR) - Any rate-setting mechanism which attempts to link rewards (generally profits) to desired results or targets. PBR sets rates, or components of rates, for a period of time based on external indices rather than a utility's cost-of-service. Other definitions include light-handed regulation which is less costly and less subject to debate and litigation. A form of rate regulation which provides utilities with better incentives to reduce their costs than does cost-of-service regulation.

PERSISTENCE STUDY - A study to assess changes in net program impacts over time (that include retention and technical degradation).

PGC - See PUBLIC GOODS CHARGE.

PORTFOLIO - All IOU and non-IOU energy efficiency programs funded through the PGC that are implemented during a program year or cycle.

POST RETROFIT PERIOD - The time following a retrofit during which savings are to be determined.

PRACTICE - Generally refers to a change in a customer's behavior or procedures that reduces energy use (e.g., thermostat settings, maintenance procedures).

PRACTICE RETENTION STUDY - An assessment of the length of time a customer continues the energy conservation behavioral changes after adoption of these changes.

PRECISION - The indication of the closeness of agreement among repeated measurements of the same physical quantity. In econometrics, the accuracy of an estimator as measured by the inverse of its variance.

PROCESS EVALUATION - A systematic assessment of an energy efficiency program for the purposes of (a) documenting program operations at the time of the examination, and (b) to identify and recommend improvements that can be made to the program to increase the program's efficiency or effectiveness for acquiring energy resources while maintaining high levels of participant satisfaction.

PROCESS OVERHAUL - Modifications to industrial or agricultural processes to improve their energy use characteristics.

PROGRAM - An activity, strategy, or course of action undertaken by an implementer or administrator using PGC funds. Each program is defined by a unique combination of program strategy, market segment, marketing approach, and energy efficiency measure(s) included.

PROGRAM (IMPLEMENTATION) CYCLE - The period of time over which programs are funded, planned and implemented. Can be an annual cycle, a bi-annual cycle or other period of time.

PROGRAM DESIGN - The method or approach for making, doing, or accomplishing an objective by means of a program.

PROGRAM DEVELOPMENT - The process by which ideas for new or revised energy efficiency programs are converted into a design to achieve a specific objective.

PROGRAM PENETRATION - The level of program acceptance among qualified customers.

PROGRAM MANAGEMENT - The responsibility and ability to oversee and guide the performance of a program to achieve its objective.

PROGRAM STRATEGIES - Refers to the type of method deployed by the program in order to obtain program participation. Some examples of program strategies include: rebates, codes, performance contracting and audits.

PROGRAM THEORY - A presentation of the goals of a program, incorporated with a detailed presentation of the activities that the program will use to accomplish those goals and the identification of the causal relationships between the activities and the program's effects.

PROGRAM YEAR - The calendar year in which program participation occurs.

PROGRAMMABLE CONTROLLER - A device that controls the operation of electrical equipment (such as air conditioning units and lights) according to a preset time schedule.

PROJECT - An activity or course of action undertaken by an implementer involving one or multiple energy efficiency measures, usually at a single site.

PROJECT DEVELOPMENT - The process by which an implementer identifies a strategy or creates a design to provide energy efficiency products, services, and practices directly to customers.

PUBLIC GOODS CHARGE (PGC) - Per Assembly Bill (AB) 1890, a universal charge applied to each electric utility Customer's bill to support the provision of public goods. Public goods covered by California's electric PGC include public purpose energy efficiency programs, low-income services, renewables, and energy-related research and development.

PUBLIC INTEREST GOALS - Public interest goals of electric utility regulation include: (a) inter-and intra-class and intergenerational equity); (b) the equal treatment of equals (horizontal equity); (c) balancing long- and short-term goals that have the potential to affect intergenerational balance; (d) protecting against the abuse of monopoly power; and (e) general protection of the health and welfare of the citizens of the state, nation, and world. Environmental and other types of social costs are subsumed under the equity and health and welfare responsibilities.

RADIANT BARRIER - A device designed to reduce or stop the flow of radiant energy.

RATIO ESTIMATOR (SAMPLING METHOD) – A sampling method to obtain increased precision by taking advantage of the correlation between an auxiliary variable and the variable of interest to reduce the coefficient of variation.

REBATES - A type of incentive provided to encourage the adoption of energy efficient practices, typically paid after the measure has been installed. There are typically two

types of rebates: a Prescriptive Rebate, which is a prescribed financial incentive per unit for a prescribed list of products and a Customized Rebate, in which the financial incentive is determined using an analysis of the customer's equipment and an agreement on the specific products to be installed. Upstream rebates are financial incentives provided for manufacturing, sales, stocking, or other per unit energy efficient product movement activities designed to increase use of particular type of products.

REBOUND EFFECT - A change in energy using behavior that yields an increased level of service and that occurs as a result of taking an energy efficiency action.

RECALL - The ability to remember an event and discuss reactions to the event. Typically used in market effects evaluations in which a number of people may have been exposed to a promotional message, but only a small percent may remember (or recall) the message and be able to discuss the influence of the message.

RECALL RESPONSE RATE - The percent of a target market exposed to a message that recalls the message.

REGRESSION MODEL - A mathematical model based on statistical analysis where the dependent variable is regressed on the independent variables which are said to determine its value. In so doing, the relationship between the variables is estimated statistically from the data used.

RELIABILITY - When used in energy evaluation, refers to the likelihood that the observations can be replicated.

REMODELING - Modifications to the characteristics of an existing residential or non-residential building or energy-using equipment installed within it.

RENEWABLE ENERGY - Resources that constantly renew themselves or that are regarded as practically inexhaustible. These include solar, wind, geothermal, hydro and wood. Although particular geothermal formations can be depleted, the natural heat in the earth is a virtually inexhaustible reserve of potential energy. Renewable resources also include some experimental or less-developed sources such as tidal power, sea currents and ocean thermal gradients.

RENEWABLE RESOURCES - Renewable energy resources are naturally replenishable, but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Some (such as geothermal and biomass) may be stock-limited in that stocks are depleted by use, but on a time scale of decades, or perhaps centuries, they can probably be replenished. Renewable energy resources include: biomass, hydro, geothermal, solar and wind. In the future they could also include the use of ocean thermal, wave, and tidal action technologies. Utility renewable resource applications include bulk electricity generation, on-site electricity generation, distributed electricity generation, non-grid-connected generation, and demand-reduction (energy efficiency) technologies.

RENOVATION - Modifications to the characteristics of an existing residential or non-residential building itself, including but not limited to windows, insulation, and other modifications to the building shell.

REPLACEMENT - Refers to the changing of equipment either due to failure, move to more efficient equipment or other reasons near the end of product life or earlier. Often used to refer to a move to a more energy efficient product that replaces an inefficient product.

RESEARCH AND DEVELOPMENT (R&D) - Research is the discovery of fundamental new knowledge. Development is the application of new knowledge to develop a potential new service or product. Basic power sector R&D is most commonly funded and conducted through the Department of Energy (DOE), its associated government laboratories, university laboratories, the Electric Power Research Institute (EPRI), and private sector companies.

RESIDENTIAL BUILDING - Means any hotel, motel, apartment house, lodging house, single and dwelling, or other residential building that is heated or mechanically cooled.

RESIDENTIAL CUSTOMER - Existing single family residences, multi-family dwellings (whether master-metered or individually metered), and buildings that are essentially residential but used for commercial purposes, including, but not limited to, time shares and vacation homes.

RESIDENTIAL HARD-TO-REACH - Those customers who do not have easy access to program information or generally do not participate in energy efficiency programs due to a language, income, housing type, geographic, or home ownership (split incentives) barrier.

RETAIL MARKET - A market in which electricity and other energy services are sold directly to the end use customer.

RETENTION (MEASURE) - The degree to which measures are retained in use after they are installed.

RETROFIT - Energy efficiency activities undertaken in existing residential or non-residential buildings where existing inefficient equipment is replaced by efficient equipment.

RETROFIT ISOLATION - The savings measurement approach defined in the International Performance Measurement and Verification Protocols (IPMVP) Options A and B, and ASHRAE Guideline 14 that determines energy or demand savings through the use of meters to isolate the energy flows for the system(s) under consideration.

ROADMAP - Set of decision trees or decision flow diagrams that support the process of determining if an evaluation of the program is necessary, and what type of evaluations, methods or steps can be used.

R-VALUE - A unit of thermal resistance used for comparing insulating values of different material. It is basically a measure of the effectiveness of insulation in stopping heat flow. The higher the R-value number, a material, the greater its insulating properties and the slower the heat flow through it. The specific value needed to insulate a home depends on climate, type of heating system and other factors.

SAE - See STATISTICALLY ADJUSTED ENGINEERING MODELS.

SAMPLE DESIGN - The approach used to select the sample units.

SAMPLING ERROR - The error in estimating a parameter caused by the fact that in the sample at hand all the disturbances are not zero.

SAVINGS DETERMINATION - The process of separating a retrofit's (energy efficiency measure's) effectiveness from a facility's energy use pattern. It involves measurements of physical conditions and analysis of resultant data.

SAVINGS MEASUREMENT APPROACH - The estimation of energy and demand savings associated with an energy efficiency measure for a piece of equipment, a subsystem, or a system. The estimated savings are based on some kind of measured data from before and after the retrofit and may be calculated using a variety of engineering techniques.

SEASONAL ENERGY EFFICIENCY RATIO (SEER) - The total cooling output of a central air conditioning unit in Btus during its normal usage period for cooling divided by the total electrical energy input in watt-hours during the same period, as determined using specified federal test procedures. (Title 20, Section 2-1602(c)(11).

SERIAL CORRELATION - See AUTOCORRELATION.

SENSIBLE HEAT - Heat that results in a temperature change.

SERVICE AREA - The geographical territory served by a utility.

SETBACK THERMOSTAT - See THERMOSTAT, SETBACK.

SHADE SCREEN - A screen affixed to the exterior of a window or other glazed opening designed to reduce the solar radiation reaching the glazing.

SHADING - (a) The protection from heat gains due to direct solar radiation; (b) Shading is provided by (1) permanently attached exterior devices, glazing materials, adherent materials applied to the glazing, or an adjacent building for non-residential buildings,

hotels, motels and high rise apartments, and by (2) devices affixed to the structure for residential buildings. [See California Code of Regulations, Title 24, Section 2-5302]

SHADING COEFFICIENT (SC) - The ratio of solar heat gain through fenestration, with or without integral shading devices, to that occurring through unshaded 1/8 in. thick clear double strength glass. See also **SOLAR HEAT GAIN COEFFICIENT**.

SHGC - See **SOLAR HEAT GAIN COEFFICIENT**.

SIMPLE RANDOM SAMPLING - A method of selecting n sample units out of the N population such that every one of the distinct N items has an equal chance of being selected.

SIMPLIFIED ENGINEERING MODEL - Engineering equations used to calculate energy usage and/or savings. These models are usually based on a quantitative description of physical processes that describe the transformation of delivered energy into useful work such as heat, lighting or motor drive. In practice, these models may be reduced to simple equations that calculate energy usage or savings as a function of measurable attributes of customers, facilities or equipment (e.g., lighting use = watts X hours of use). These models do not incorporate billing data and do not produce estimates of energy savings to which tests of statistical validity can be applied.

SOLAR HEAT GAIN - Heat added to a space due to transmitted and absorbed solar energy.

SOLAR HEAT GAIN COEFFICIENT (SHGC) - The ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation.

SOLAR HEAT GAIN FACTOR - An estimate used in calculating cooling loads of the heat gain due to transmitted and absorbed solar energy through 1/8"-thick, clear glass at a specific latitude, time and orientation.

SOLAR HEATING AND HOT WATER SYSTEMS - Solar heating or hot water systems provide two basic functions: (a) capturing the sun's radiant energy, converting it into heat energy, and storing this heat in insulated storage tank(s); and (b) delivering the stored energy as needed to either the domestic hot water or heating system. These components are called the collection and delivery subsystems.

SPECIAL CONTRACTS - Any contract that provides a utility service under terms and conditions other than those listed in the utility's tariffs. For example, an electric utility may enter into an agreement with a large customer to provide electricity at a rate below the tariffed rate in order to prevent the customer from taking advantage of some other option that would result in the loss of the customer's load. This generally allows that customer to compete more effectively in their product market.

SPILLOVER - Reductions in energy consumption and/or demand in a utility's service area caused by the presence of the DSM program, beyond program related gross savings of participants. These effects could result from: (a) additional energy efficiency actions that program participants take outside the program as a result of having participated; (b) changes in the array of energy-using equipment that manufacturers, dealers, and contractors offer all customers as a result of program availability; and (c) changes in the energy use of non-participants as a result of utility programs, whether direct (e.g., utility program advertising) or indirect (e.g., stocking practices such as (b) above, or changes in consumer buying habits).

SPLIT-THE-SAVINGS (Electric Utility) - The basis for settling economy-energy transactions between utilities. The added costs of the supplier are subtracted from the avoided costs of the buyer, and the difference is evenly divided.

SPURIOUSNESS OR SPURIOUS CORRELATION - The apparent association between two variables that is actually attributable to a third variable outside the current analysis, probably a common precedent variable.

STAKEHOLDERS - In program evaluation, stakeholders refer to the myriad of parties that are impacted by a program. Stakeholders include: regulatory staff, program designers, implementers and evaluators, energy producers, special interest groups, potential participants and customers.

STANDARD DEVIATION - The square root of the variance.

STANDARD PERFORMANCE CONTRACT (SPC) - Programs consisting of a set of agreements between the administrator or implementer and a number of project sponsors (either implementers or customers) to deliver energy savings from the installation of energy efficiency measures and technologies at a facility or set of facilities. These agreements are for a pre-specified price per unit of energy savings, measured using a pre-specified set of measurement and verification (M&V) protocols. An SPC program is an open-ended offer with a pre-specified price and set of terms.

STANDBY LOSS - A measure of the losses from a water heater tank. When expressed as a percentage, standby loss is the ratio of heat loss per hour to the heat content of the stored water above room temperature. When expressed in watts, standby loss is the heat lost per hour, per square foot of tank surface area. [See California Code of Regulations, Title 20, Section 1602(f)(5)]

STATEWIDE MARKETING AND OUTREACH PROGRAMS - Programs that convey consistent statewide messages to individual consumers through mass-market advertising campaign.

STATEWIDE PROGRAM - A program available in the service territories of all four large IOUs, with identical implementation characteristics in all areas, including incentives and application procedures.

STATISTICAL ANALYSIS - Extrapolation of sample data up to the population, calculation of error bounds.

STATISTICAL COMPARISONS - A comparison group of customers serving as a proxy of what program participants would have looked like if the program had not been offered.

STATISTICALLY ADJUSTED ENGINEERING (SAE) MODELS - A category of billing analysis models that incorporate the engineering estimate of savings as a dependent variable. The regression coefficient in these models is the percentage of the engineering estimate of savings observed in changes in energy usage. For example, if the coefficient on the SAE term is 0.8, this means that the customers are on average realizing 80% of the savings from their engineering estimates.

STEADY-STATE EFFICIENCY - A performance rating for space heaters; a measure of the percentage of heat from combustion of gas which is transferred to the space being heated under specified steady-state conditions. [See California Code of Regulations, Title 20, Section 1602(e)(13)]

STRANDED BENEFITS - Public interest programs and goals which could be compromised or abandoned by a restructured electric industry. These potential “stranded benefits” might include: environmental protection, fuel diversity, energy efficiency, low-income ratepayer assistance, and other types of socially beneficial programs.

STRATIFIED RANDOM SAMPLING – The population is divided into N units of subpopulations that are non-overlapping and together comprise the entire population, called strata. A simple random sample is taken of each strata to create a sample based upon stratified random sampling.

STRATIFIED RATIO ESTIMATION - A sampling method that combines a stratified sample design with a ratio estimator to reduce the coefficient of variation by using the correlation of a known measure for the unit (e.g., expected energy savings) to stratify the population and allocate sample from strata for optimal sampling.

SUNK COST - In economics, a sunk cost is a cost that has already been incurred, and therefore cannot be avoided by any strategy going forward.

SUPPLY-SIDE - Activities conducted on the utility’s side of the customer meter. Activities designed to supply electric power to customers, rather than meeting load through energy efficiency measures or on-site generation on the customer side of the meter.

SYSTEM - A combination of equipment and/or controls, accessories, interconnecting means, and terminal elements by which energy is transformed so as to perform a specific function, such as HVAC, service water heating, or illumination.

SYSTEM INTEGRATION (OF NEW TECHNOLOGIES) - The successful integration of a new technology into the electric utility system by analyzing the technology's system effects and resolving any negative impacts that might result from its broader use.

TECHNICAL DEGRADATION FACTOR - A multiplier used to account for time-and-use-related change in the energy savings of a high efficiency measure or practice relative to a standard efficiency measure or practice.

TECHNICAL POTENTIAL - The complete penetration of all measures analyzed in applications where they were deemed technically feasible from an engineering perspective.

TEMPERATURE - Degree of hotness or coldness measured on one of several arbitrary scales based on some observable phenomenon (such as the expansion).

THERM - One hundred thousand (100,000) British thermal units (1 therm = 100,000 Btu).

THERMAL BREAK (thermal barrier) - An element of low heat conductivity placed in such a way as to reduce or prevent the flow of heat. Some metal framed windows are designed with thermal breaks to improve their overall thermal performance.

THERMAL CONDUCTANCE (C) - The constant time rate of heat flow through unit area of a body induced by a unit temperature difference between the surfaces, Btu/(ft²-h-oF) or W/(m²-K). It is the reciprocal of thermal resistance. See THERMAL RESISTANCE.

THERMAL MASS - A material used to store heat, thereby slowing the temperature variation within a space. Typical thermal mass materials include concrete, brick, masonry, tile and mortar, water, and rock or other materials with high heat capacity.

THERMAL RESISTANCE (R) - The reciprocal of thermal conductance; 1/C as well as 1/h, 1/U, h-ft²-oF/Btu.

THERMAL (ENERGY) STORAGE - A technology that lowers the amount of electricity needed for comfort conditioning during utility peak load periods. A buildings thermal energy storage system might, for example, use off-peak power to make ice or to chill water at night, later using the ice or chilled water in a power saving process for cooling during the day. See THERMAL MASS.

THERMOSTAT - An automatic control device designed to be responsive to temperature and typically used to maintain set temperatures by cycling the HVAC system.

THERMOSTAT, SETBACK - A device, containing a clock mechanism, which can automatically change the inside temperature maintained by the HVAC system according to a preset schedule. The heating or cooling requirements can be reduced when a building

is unoccupied or when occupants are asleep. [See California Code of Regulations, Title 24, Section 2- 5352(h)]

TIME-OF-USE METER - A measuring device that records the times during which a customer uses various amounts of electricity. This type of meter is used for customers who pay time-of-use rates.

TIME-OF-USE (TOU) RATES - Electricity prices that vary depending on the time periods in which the energy is consumed. In a time-of- use rate structure, higher prices are charged during utility peak-load times. Such rates can provide an incentive for consumers to curb power use during peak times.

TOTAL RESOURCE COST TEST – SOCIETAL VERSION - A cost-effectiveness test intended to measure the overall cost-effectiveness of energy efficiency programs from a societal perspective.

TOU - See TIME OF USE RATES.

TRIANGULATION - Comparing the results from two or more different data gathering or measurement techniques on the same problem to derive a “best” estimate from the analysis of the comparison.

UA - A measure of the amount of heat that would be transferred through a given surface or enclosure (such as a building envelope) with a one degree Fahrenheit temperature difference between the two sides. The UA is calculated by multiplying the U-Value by the area of the surface (or surfaces).

UNCERTAINTY - The range or interval of doubt surrounding a measured or calculated value within which the true value is expected to fall within some degree of confidence.

UNCERTAINTY ANALYSIS - (a) A procedure or method by which the uncertainty of a measured or calculated value is determined; (b) the process of determining the degree of confidence in the true value when using a measurement procedure(s) and/or calculation(s).

UNCONDITIONED SPACE - A space that is neither directly nor indirectly conditioned space, which can be isolated from conditioned space by partitions and/or closeable doors. [See California Code of Regulations, Title 24, Section 2-5302].

UNIVERSAL SERVICE - Electric service sufficient for basic needs (an evolving bundle of basic services) available to virtually all members of the population regardless of income.

UPGRADE (Electric utility) - Replacement or addition of electrical equipment resulting in increased generation or transmission capability.

UPSTREAM PROGRAMS - Programs that provide information and/or financial assistance to entities in the delivery chain of high-efficiency products at the retail, wholesale, or manufacturing level.

UTILITY METER - The meter used to calculate a monthly energy and/or demand charge at a specific utility/customer connection; more than one may be installed per customer and per site due to different supply voltages, capacity requirements, physical separation distances, installation periods, or for specific customer requirements or utility programs.

U-VALUE/U-FACTOR - A measure of how well heat is transferred by the entire window - the frame, sash and glass - either into or out of the building. U-value is the opposite of R-value. The lower the U-factor number, the better the window will keep heat inside a home on a cold day.

VARIABLE AIR VOLUME (VAV) HVAC system - HVAC systems that control the dry-bulb temperature within a space by varying the volume of supply air to the space.

VENTILATION - The process of supplying or removing air by natural or mechanical means to or from any space. Such air may or may not have been conditioned or treated.

VERIFICATION PHASE - The step of the California Energy Contingency Plan to determine the existence and scope of an energy shortage and report to Energy Commission executives, the Governor and the Legislature where required under the plan.

WATT - A unit of measure of electric power at a point in time, as capacity or demand. One watt of power maintained over time is equal to one joule per second. Some Christmas tree lights use one watt. The watt is named after Scottish inventor James Watt and is capitalized when shortened to W and used with other abbreviations, as in kWh.

WATT-HOUR - One watt of power expended for one hour. One thousandth of a kilowatt-hour.

WEATHERSTRIPPING - Specially designed strips, seals and gaskets installed around doors and windows to limit air leakage.

WET-BULB TEMPERATURE - The temperature at which water, by evaporating into air, can bring the air to saturation at the same temperature. Wet-bulb temperature is measured by a wet-bulb psychrometer.

WHOLE-BUILDING CALIBRATED SIMULATION APPROACH - The savings measurement approach defined in the International Performance Measurement and Verification Protocols (IPMVP) Option D and ASHRAE Guideline 14, which involves the use of an approved computer simulation program to develop a physical model of the building in order to determine energy and demand savings. The simulation program is used to model the energy used by the facility before and after the retrofit. The pre- or

post-retrofit models are developed by calibration with measured energy use and demand data and weather data.

WHOLE-BUILDING METERED APPROACH - The savings measurement approach defined in the International Performance Measurement and Verification Protocols (IPMVP) Option C and ASHRAE Guideline 14 that determines energy and demand savings through the use of whole-facility energy (end use) data, which may be measured by utility meters or data loggers. This approach may involve the use of monthly utility bill data or data gathered more frequently from a main meter.

ZONE - A space or group of spaces within a building with any combination of heating, cooling, or lighting requirements sufficiently similar so that desired conditions can be maintained throughout by a single controlling device.

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* Indicates that the information was used in the construction of the Framework.

APPENDIX C: Guidelines for Evaluation Planning

This Appendix provides some example guidelines for planning and conducting evaluations. These guidelines are provided as a starting point for the evaluation planning process, but evaluation planners are also free to use alternative approaches when submitting evaluation plans. The guidelines may be particularly useful for program implementers with little evaluation experience. The Appendix first describes methods to classify programs according to program type and size. Then the Appendix provides guidelines on selecting specific evaluation activities to meet the evaluation objectives, determining evaluation priorities, and select methods for conducting evaluations.

The information in this appendix is based on several assumptions:

1. Evaluation goals and program policies and procedures are as presented in the CPUC Energy Efficiency Policy Manual (EPPM), version 2 (2003).
2. Program size distributions are similar to the programs conducted during the 2002-2003 program cycle.

As program goals, policies and procedures evolve, and as program evaluation objectives change, these guidelines will need to be modified to match those changes.

Program Classification

This Framework is one among several potential considerations for the development of evaluation approaches that meet the CPUC's evaluation policy requirements and the associated evaluation efforts. Development of the considerations beyond the Framework is outside of the scope of this project. The function of the Framework is to provide guidance to determine what aspects of the different energy efficiency programs should be evaluated and to assist the evaluation planning process. The guidance provided in the Framework is structured to inform decisions concerning when evaluations are to be conducted, what types of evaluations to conduct, and what methods should be considered for those evaluation efforts. In addition, the Framework provides guidance on the reporting of evaluation results and the discussion (within the reports) on issues related to the accuracy and reliability of the evaluation approach and the results.

There are number of program types discussed in the Framework that have a direct effect on the type of evaluation efforts to be conducted (such as resource acquisition, market transformation, information and education). Each of these program types has a set of decision criteria leading to different evaluation decisions. The highest-level criteria in the Framework is that programs are classified within these broad categories of program type, and that these categories feed into different sets of evaluation decisions. For example, resource acquisition programs have the highest evaluation priority of identifying net program/technology energy impacts (see Chapter 6 of the Framework); market transformation programs have the highest evaluation priority of identifying net

market effects leading to longer-term energy savings (see Chapter 10); and information and education programs have the highest evaluation priority of identifying the effects related to their specific program goals (see Chapter 9). The second highest priority for each of these types of programs is conducting detailed process evaluations (see Chapter 8) focusing on how a program can be changed to better accomplish their primary operational goals. For programs that rely on the value of the program's non-energy effects to achieve their energy impact goals, there may also be a desire to conduct a non-energy effects evaluation (see Chapter 11). Within each of these chapters (6-11), there are discussions of other considerations that may impact the evaluation planning process or the timing of the evaluation. These discussions focus on how the evaluation history of a program, the maturation level of a program, the need for fast feedback information, and other issues can influence the evaluation planning process.

Other information about the program can also be useful in helping decide what efforts to undertake when planning an evaluation. This appendix provides an example of different program classification schemes and approaches for using these schemes to help select the most appropriate impact evaluation methodologies.

A proposed program type classification scheme is presented in Table C.1 below. Each program administrator could assist the process of identifying the appropriate evaluation for their program by classifying their program into program types based on the specific attributes that apply to their program.

Table C.1: Sample Program Classification Scheme

Program Attribute	Description	Applies: (Yes or No)
Program size (based on expected energy impacts)	Small	
	Medium	
	Large	
Program Strategies	Audits	
	Codes and standards	
	Commissioning / Operations and Maintenance	
	Design assistance	
	Direct installation	
	Education, training, and information	
	Financing	
	Market transformation	
	Rebate - customized	
	Rebate - prescriptive	
	Performance contracting	
	Upstream	
	Other	
Market Segments	Agricultural	
	Commercial	
	Industrial	
	Residential	
	Cross-Cutting	
Market Event	New construction	
	Remodel/Renovation	
	Retrofit	
End use/measure groups	Appliances	
	Comprehensive	
	Envelope	
	Food service	
	HVAC	
	Lighting	
	Motor	
	Process	
	Refrigeration	
	Water heating	
	Water pumping / treatment	
	Other	

The proposed classification scheme is a subset of the scheme presented in Chapter 1 of the CPUC Energy Efficiency Policy Manual (EPPM), Version 2¹, with modifications to support the implementation of the Framework. A key consideration in the development and use of any classification scheme should include an assessment of how that scheme would apply across different types of evaluation and non-evaluation efforts beyond those

¹ (* CPUC 2003).

described in this Framework (e.g. load forecasting, efficiency potential studies, DEER update, etc.).

Program Size

The size distribution in terms of net electricity savings of the programs approved for the 2002-2003 program cycle, including utility and third party programs, is shown in Figure C.1. As is evident from this figure, the top three programs are responsible for almost 50% of the total projected net portfolio energy savings.

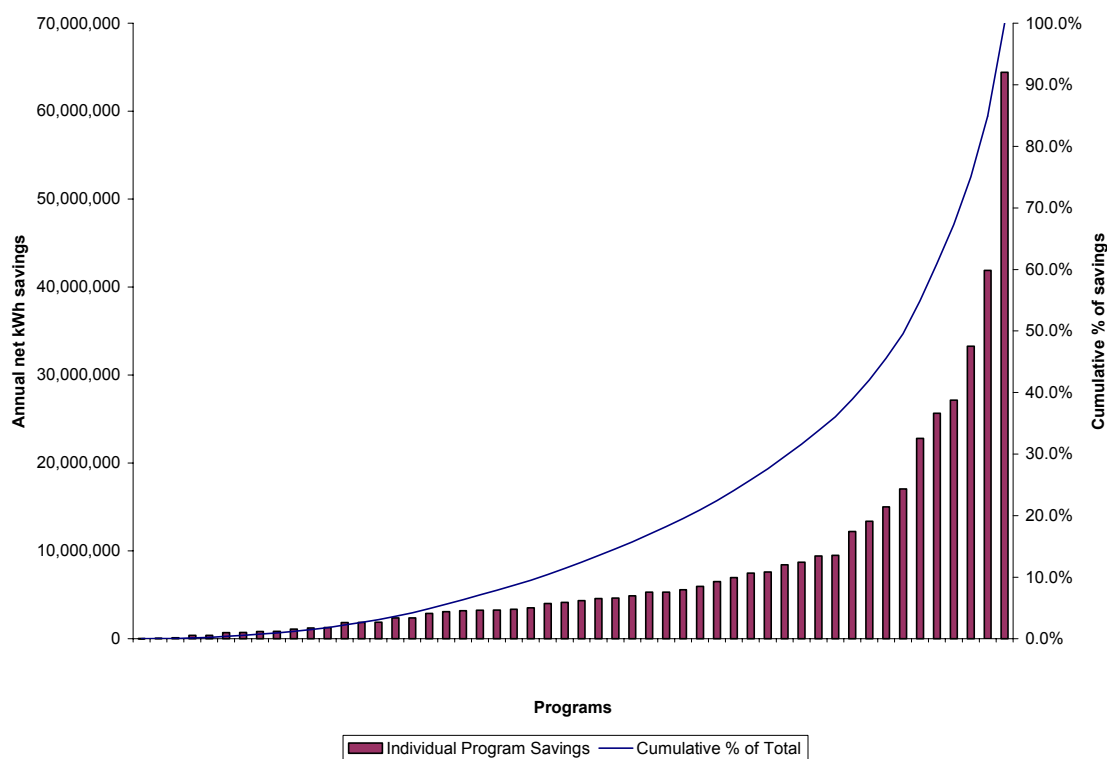


Figure C.1: Program Size Distribution based on Annual kWh Savings

Programs smaller than 4 GWh net savings per year make up about 10% of the annual net savings expected, but represent nearly 50% of the total count of programs claiming kWh savings.

The size distribution of programs claiming gas savings approved for the 2002-2003 program cycle is shown in Figure C.2.

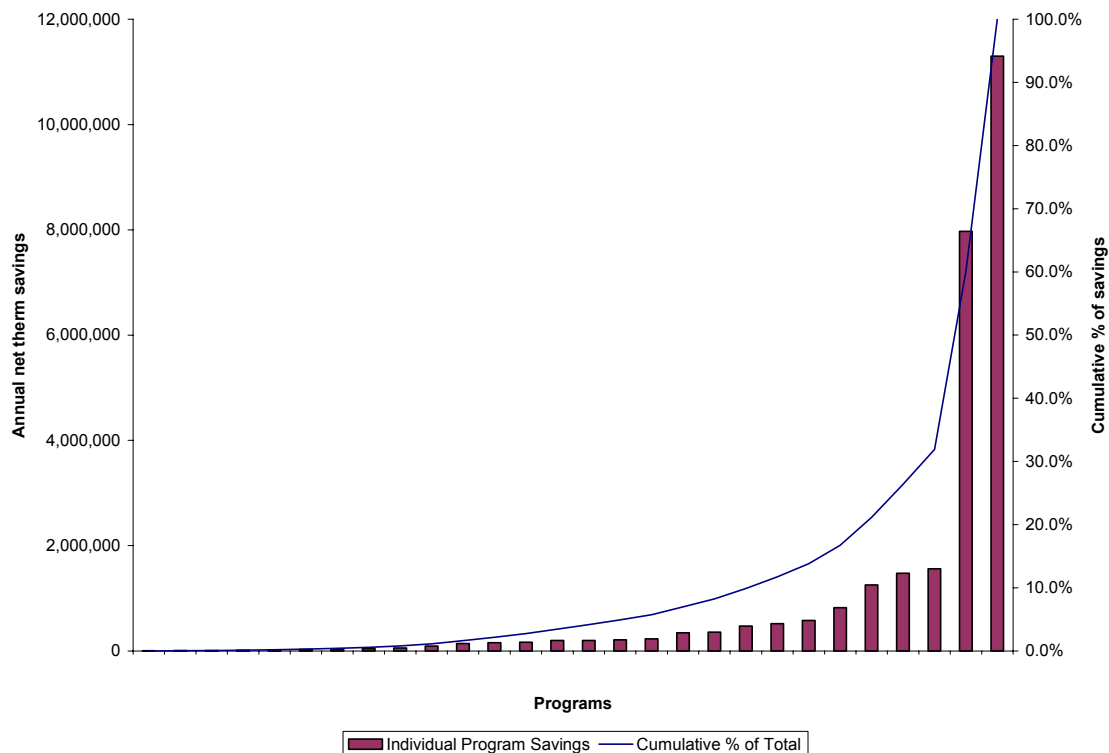


Figure C.2: Program Size Distribution Based on Annual Gas Savings

The two largest programs make up about two-thirds of the expected gas savings. Programs less than 500,000 therms per year of savings make up about 10% of the total portfolio savings, but represent 70% of the total count of programs claiming gas savings. Future program sizes may vary from those offered during this particular cycle, but it is likely that the expected savings from program to program in any program cycle will not be evenly distributed.

A program size classification is presented in Table C.2 below. Programs are classified into bins according to the fraction of the total expected first year savings represented by each bin.² This classification strategy is applied to the portfolio of program presented in the 2002-2003 program cycle. Future portfolios may require a different size classification scheme, based on the size of programs offered and the overall objectives of the portfolio.

² For example, the sum of the savings from all small programs is 5% of the portfolio total, the sum of the savings from all medium sized programs is 45% of the portfolio total, and the sum of the savings of all large programs is the remaining 50% of the total portfolio savings.

Table C.2: Program Size Classification

Size Classification	Electricity			Gas		
	Percent of Total Portfolio Savings	Estimated Program Savings	Number of Programs	Percent of Total Portfolio Savings	Estimated Program Savings	Number of Programs
Small	Up to 5%	Up to 3 GWh/yr	23	Up to 5%	Up to 200 ktherm/yr	16
Medium	5% - 50%	3 to 20 GWh/yr	28	5% - 15%	200 to 1,500 ktherm/yr	10
Large	50%-100%	20+ GWh/yr	6	15%-100%	1,500+ ktherm/yr	2

Program Strategies

Program design strategies referenced in the classification scheme are described below.

Audits. Audit programs involve the inspection of a home, building or industrial process by an expert who makes recommendations on strategies to reduce customer energy consumption. Data relating to the characteristics of the building or process may be collected by an energy auditor during an on-site inspection or supplied by the customer.

Codes and standards. Codes and standards programs provide technical, financial and/or market information and testimony to the California Energy Commission (CEC) for the purpose of enhancing building energy and appliance efficiency standards.

Commissioning/operations and maintenance. Building commissioning provides documented confirmation that building systems as constructed function in accordance with the intent of the building designers, and satisfy the owner's operational needs. Commissioning programs can provide both technical assistance and incentives to support commissioning activities. Commissioning carried out in existing facilities is generally called "Retro-commissioning." Operations and Maintenance programs provide information, engineering analysis and/or incentives to improve the building operations and maintenance practices.

Design assistance. Design assistance programs provide design and analysis services to architects and engineers responsible for the design of new residential and commercial buildings. Such services are structured to influence the design of the building to make it more energy efficient. Design strategies may also emphasize non-energy benefits such as improved indoor air quality, comfort, and lighting quality as a package of features, structured to meet the goals of the building owner or occupant.

Direct installation. Direct installation programs provide free energy efficiency measures for qualified customers. These are generally delivered to the customer and installed without charge. Measures generally distributed in direct install programs include low-cost measures such as compact fluorescent lamps, low-flow shower heads and faucet

aerators; but may also include comprehensive lighting, weatherization or HVAC system tuneup services.

Information and Education. Information and education programs can provide a wide range of activities designed to inform or educate a customer or customer group. Generally these range from in-depth, one-on-one, on-site or centrally located classroom style instruction in topics related to energy efficiency, to programs that target information to specific types of customers, to general information provided to a wide range of customers, to short inexpensive public service announcements on FCC approved communication frequencies.

Information and education programs can also develop curriculums and/or provide or prepare presentations for elementary or secondary schools and colleges. These can range from handouts and brochures to supplement a science curriculum, all the way to interactive educational media and projects where the installation of measures at a school is part of the learning process with the students (an education program that complements or interacts with a resource acquisition program).

Information and education programs may also focus on a particular media using specifically targeted audiences or specifically targeted messages. They can include public service announcements; radio, television, or newspaper advertising; cooperative advertising; community events at ball games, schools, fairs, etc.; work with community organizations; trade show events; web-based efforts (including banner advertising and location-specific "click-throughs"); and many other avenues of providing information and education.

Programs that have as their primary objective to inform or educate customers about ways to save, manage, or control their energy use can be considered an information or education program.

Financing. Financing programs encourage investments in energy efficiency through offering below market interest rates or terms, gap financing, financial packaging, and/or simplified administrative procedures.

Market transformation. Market transformation programs seek to improve the adoption of energy efficient technologies and practices by permanently reducing or eliminating market barriers to technology adoption. They seek to "transform" the market to change the market structure, operation, or decision-making in such a way to yield greater opportunity and likelihood for more energy efficient equipment and practices being adopted and sustained. Often these programs are distinguished from resource acquisition programs in that their primary gains in energy and demand savings are not obtained directly, but through market changes that lead to the increased adoption of the desired equipment or practices without direct participant-focused program intervention. (See Chapter 10 on Market Transformation Program Evaluation and the *2001 Framework Study* for additional information on these types of programs and how they are different from resource acquisition programs.)

Rebate – customized. Customized rebate programs provide financial incentives based on an analysis of the customer’s existing equipment and an agreement on the specific products to be installed. The rebate amount is generally tied to the expected energy savings calculated on a customer-by-customer basis.

Rebate – prescriptive. Prescriptive rebate programs provide a prescribed financial incentive per unit of efficient technology installed or per unit of efficiency improvement for a prescribed list of individual products.

Performance contracting. Performance contracting programs consist of contracts between a program implementer and associated contractors (and/or customers) to deliver energy savings from the installation of energy efficiency measures at a customer facility. The measures are installed in exchange for a payment stream based on a portion of verified energy savings. Energy savings are generally verified through a predefined set of Measurement and Verification (M&V) protocols.

Upstream programs. Upstream programs provide information and/or financial assistance to entities involved in the delivery chain of high-efficiency products at the retail, wholesale, or manufacturing level. They can be part of a resource acquisition effort or a market transformation initiative. Incentives are paid to persons other than the eventual end user. Examples include incentives to promote the stocking of high efficiency equipment at the wholesale level, rebates offered to contractors to offset the incremental cost of efficient appliances or equipment, or programs promoting the design and manufacture of efficient products.

Other. This category covers programs not otherwise mentioned in this section.

Market Segments

Programs are generally targeted at customers within specific markets. The program classification scheme uses the following market segment definitions:

Residential. Residential customers are defined as existing single family residences, multi-family dwellings (whether master-metered or individually metered), and customers within facilities that are essentially residential but used for commercial purposes, including, but not limited to, time shares and vacation homes.

Commercial (and Institutional). Customers occupying facilities used for business, commercial and institutional purposes.

Agricultural. Customers engaged in enterprises defined as agricultural by the U.S. Department of Commerce.

Industrial. Customers engaged in enterprises defined as industrial by the U.S. Department of Commerce.

Crosscutting. Programs offered to multiple markets are classified as crosscutting.

Market Event

Programs are designed to engage customers at various market events, including:

Retrofit/early replacement: Retrofit refers to energy efficiency activities undertaken in existing buildings or facilities to promote early replacement of existing inefficient equipment with efficient equipment.

Remodel/Renovation. Modifications to the characteristics of an existing building or facility, or the energy-using equipment installed within, involving (1) construction that involves complete removal, redesign, and replacement of the energy consuming systems of a building or process, (2) projects that require design and selection of new systems based upon the needs of new or modified space function(s), and (3) major tenant improvements that add new load. Renovation refers to remodels involving changes to the building shell.

Replacement. Normal replacement of equipment, either as a result of an emergency such as equipment failure, or as part of a broader planned event intended to change equipment near the end of its service life but prior to failure.

New construction. Residential and non-residential buildings that have been newly built or have added major additions subject to Title 24, the California building energy efficiency standards, including (1) new building projects wherein no structure or site footprint presently exist (“greenfield”); (2) addition or expansion of an existing building or site footprint; or (3) addition of new load, as in the example of an existing site adding a new process.

End use or Measure Groups

Programs may be designed to focus on one or more end uses or measures, as described below:

Appliances. Household appliances such as refrigerators, clothes washers and dryers, room air conditioners, etc. Although these measures are generally promoted to residential customers, they may be applied to any market segment.

Building Envelope. Improvements to the building shell, including exterior roofs, walls, windows, air leakage sealing and weatherization.

Food Service. Efficient technology for retail preparation of food for sale in restaurants and groceries. Measures generally include improved cook line equipment and commercial kitchen ventilation systems. Food processing programs addressing industrial

processing of produce, livestock, dairy products, etc., for wholesale distribution should be classified as an industrial process measure, as described below.

HVAC. Equipment designed to provide heating, ventilation and/or air conditioning. Includes furnaces, central air conditioners, ventilation systems, chillers, boilers, energy management control systems, etc. Efficient motors and motor controls applied to HVAC system fans, pumps, chillers, cooling towers, etc., are included in this category.

Lighting/Daylighting. Equipment, control systems, and architectural features designed to provide illumination in buildings. Includes efficient lamps, ballasts, lighting fixtures (luminaries), lighting controls (such as occupancy sensors, dimming controls, timers) and fenestration (such as windows, clerestories, skylights) designed to admit natural light for space illumination.

Motors. Energy efficient motors and controls for non-HVAC drive power applications.

Process. Improvements in industrial processes that reduce the energy consumption per unit of production output. This could include processing equipment, process layout, processing design, and input and output process management (including material waste-stream management).

Refrigeration. Improvements to refrigeration systems applied to grocery stores, restaurants, food processing, refrigerated warehouses and industrial applications. Includes efficient compressors, oversized condensers, close approach evaporators, systems controls, etc. Shell and lighting improvements to refrigerated warehouses are generally classified as refrigeration, not building envelope measures.

Water heating. Efficient equipment applied to service or potable water heating, including water heaters, boilers, water heater controllers, water heat tank and pipe insulation.

Water pumping / treatment. Equipment applied to the pumping, storage and treatment of drinking water, wastewater, and agricultural irrigation.

Comprehensive. Multiple end uses or measure groups applied to building or facility in the context of an integrated or systems approach

Other. Measures or end uses not otherwise listed.

CPUC Evaluation Objectives

The CPUC Energy Efficiency Policy Manual, Version 2³ lists the following objectives for program evaluations:

1. Measure energy and peak savings;
2. Measure cost effectiveness;
3. Provide upfront market assessment and baseline analysis;
4. Provide ongoing feedback and guidance to the program administrator;
5. Measure indicators of effectiveness and testing program theory and approach;
6. Assess the overall levels of performance and success;
7. Inform decisions regarding compensation and final payments; and
8. Help assess the continuing need for the program.

The role of the principal evaluation disciplines (impact, process, market effects, and non-energy effects) in meeting these objectives is described below:

Measure Energy and Peak Savings

Impact evaluation, supported by measurement and verification is primarily used to provide estimates of resource acquisition program energy and demand savings. Likewise evaluations that focus on identifying changes in market effects can be used to inform an impact evaluation that estimates longer-term energy savings from market transformation programs.

Measure Cost Effectiveness

Cost effectiveness is measured from an estimate of the program costs and benefits, as described in Chapter 14 and the *California Standard Practice Manual*.⁴ Impact evaluation is the primary method for establishing program benefits in terms of energy and demand savings. Non-energy effects, as they relate to the cost effectiveness calculations also may play a role for programs able and allowed to claim non-energy effects in their program accomplishments. However, the non-energy effects are not to be included in an assessment of the cost-effectiveness associated with acquiring energy resources. Program costs and the accuracy of the reporting systems and operational processes may be investigated during process evaluations that inform cost effectiveness assessments.

³ (* CPUC 2003).

⁴ (* California State Governor's Office 2001).

Provide Upfront Market Assessment and Baseline Analysis

Market assessments and market baseline analysis are generally conducted through market transformation program evaluations. These broad, market-wide evaluations are used as a reference to establish program-specific baselines. Each program is responsible for determining the appropriate baseline conditions for the program's operation and evaluation. Impact evaluations generally rely on a clear definition of the program baseline, though baseline analyses are generally not conducted as a component of impact evaluation.

Provide Ongoing Feedback and Guidance to the Program Administrator

Process evaluations and Measurement and Verification (M&V) studies are conducted to inform the impact assessment, but are also conducted to provide feedback on the program's operations, measure installation quality, in-field measure performance, installation contractor quality, public relations, etc. Using the process evaluation for feedback to the program implementer is discussed in more detail in Chapter 8.

Measure Indicators of Effectiveness and Testing Program Theory and Approach

This goal is primarily addressed during process evaluations, with input from the impact and M&V studies. The Chapter 4 discussion on program theory can help provide some background and guidance for understanding and using the program theory for this purpose.

Assess the Overall Levels of Performance and Success

Overall levels of performance and success are measured on many levels and include input from impact, process, market and non-energy effects evaluations as appropriate. This evaluation goal is met through the combination of all of the evaluation efforts associated with a specific type of program and suggests that a comprehensive evaluation approach is needed for each program. The Framework is constructed so that this goal will be met through the combination of program-specific evaluations.

Inform Decisions Regarding Compensation and Final Payments

At this time, compensation and final payments are based on ex-ante savings estimates and program accomplishments based on numbers of installations completed. M&V and process evaluations are used to verify the measure installation counts for final payment determination.

Help Assess the Continuing Need for the Program

Several information sources can be used to assess the continuing need for a program. These include market potential studies, formal or informal market assessments, documented program accomplishments and accomplishment rates, energy saving goal

attainment and attainment rates, program cost effectiveness ratios, process evaluation results, program participation rates, program outreach and promotional success and other information can be used to help assess the continuing need for a program. Since multiple programs may operate in a particular market, it may not be possible for any particular program evaluation to judge the effect of the program on the overall market. The decision to continue the program rests with the portfolio administrator and the CPUC rather than the program administrator, but cost effectiveness, accomplishments, net impacts and process evaluation results are key components to the overall decision. Key information to inform this decision includes:

- Overall accomplishments, in terms of total number of measures installed and customers contacted.
- Estimate of the market penetration and remaining market that could be served by the program, including program enrollment waiting lists.
- Cost-effectiveness of the program, based on ex-post net impacts and verified program costs.
- Measures of customer satisfaction from process evaluations.

The role of each evaluation discipline in meeting the CPUC evaluation goals is shown in Table C.3.

Table C.3: Evaluation Goals and Study Type

CPUC Evaluation Goal	Evaluation Type			
	Impact	Process	Market Effects	Non-energy effects
Measure energy and peak savings	●			
Measure cost effectiveness	●			●
Provide up-front market assessment and baseline analysis	○		●	
Provide ongoing feedback and guidance to the program administrator;	●	●		
Measure indicators of effectiveness and testing program theory and approach		●		○
Assess the overall levels of performance and success	●	●		○
Inform decisions regarding compensation and final payments	●		○	
Help assess the continuing need for the program		●	○	

Note: ● indicates primary role; ○ indicates secondary role

Evaluation Priorities

The CPUC evaluation goals direct evaluators to conduct impact and process evaluations of all programs. Non-energy effects evaluations may also be included if the program theory indicates that non-energy effects are a key factor in attaining the program energy and demand impact goals. Market evaluations are generally conducted on a market-wide rather than on an individual program basis, with the exception of market transformation programs. Guidelines for establishing the priorities in evaluation rigor and resource allocation are described below.

Risk to Portfolio Performance

Evaluation resources would yield the greatest overall value by being allocated based upon minimizing uncertainty at the portfolio level. Thus, large programs with uncertain or unproven impact results would receive more resources than small or predictable programs. For example, the uncertainty in the expected savings is a function of a number of factors, including:

Measure types promoted. Evaluation knowledge and user circumstances vary by measure type. Therefore, uncertainty also varies by measure type. Lighting measures in general are fairly well characterized based on the long operating history of lighting efficiency programs in California. HVAC measures are less certain, due to variability in operating hours, control, and building load characteristics. Measures involving building controls, operations and maintenance and/or commissioning are even less certain, due to the possibility of occupant tampering and changes that can defeat these measures.

Market penetration and delivery mechanism. Expected savings are based on the ability of the program to meet measure installation goals. If a particular program is having trouble meeting installation goals due to a flawed program design or inadequate market interest, then the expected savings are at greater risk. Programs that are well designed and well established, and operate in markets that have sufficient demand represent a lower risk to the portfolio.

The risk assessed and minimized based on evaluation results is not only that of the current portfolio, but to some future portfolio of programs. Programs that are currently small, but may contain significant upside potential in a future efficiency portfolio may justify increased evaluation resources to minimize future risks. Therefore, a small program that would appear at first to warrant the use of lower cost evaluation strategy may warrant a more extensive evaluation based on future growth potential.

Prior Evaluation History

The Framework suggests that program implementers examine their program evaluation requirements and construct an evaluation plan with evaluation activities scheduled throughout the program cycle so that evaluation efforts can be scheduled and funded as they are needed. The Framework Umbrella (Chapter 5) generally suggests that program implementers conduct full program net impact evaluation during each program cycle.

However, the scope of the evaluation activities should consider recent evaluation history in order to provide the best use of evaluation resources. Evaluation planners should consider the following questions when developing evaluation plans:

- Is the program new to the market?
- How recent was the last program evaluation?
- Have there been substantial changes since the last evaluation in terms of technologies, procedures, rebate levels, energy costs, economic activity, delivery mechanisms, etc., that may substantially alter the results from the prior evaluation?

New programs should plan to conduct full net impact evaluations during the first program cycle. Continuing programs experiencing stable impact results can propose to skip a program cycle, based on a justification addressing the issues described above. See Chapter 5, Umbrella Framework, for more information concerning when an impact evaluation should be conducted.

Method Selection for Impact Evaluations

The analysis technique applied to the program impact evaluation depends primarily on the following factors.

- Program size
- Market event
- Expected impacts as a fraction of total billing
- Program strategy

Program Size

Impact evaluation resources should be directed at minimizing the uncertainty in the estimate of the efficiency resource at the portfolio level (or minimizing the risk in efficiency investments). This logically will place more evaluation resources and increased rigor on programs with large expected impacts and/or large expected uncertainty.

Market Event

New construction, remodeling and renovation programs generally require engineering analysis, since pre-program billing data are not available.⁵

⁵ It may however be possible to conduct a billing analysis for a residential new construction program if a non-participant comparison group can be identified and the econometric model includes variables for climate, economic activity, building size and orientation, and program participation. This approach may work best in circumstances with close matching, such as where participants and non participants are identified within a single large subdivision of homes with similar design.

Expected Impacts as a Fraction of Total Billing

As a general rule, efficiency programs may need to affect the customer's monthly energy consumption by at least 10% for a billing analysis to be feasible. Smaller impacts as a percentage of the total consumption may not be discernable from the random "noise" in the billing data. For example, the annual energy consumption impact of a CFL replacement program may not be large enough to allow the use of a billing analysis. Commercial comprehensive retrofit programs may provide energy savings on the order of 20% to 30%, which can be detected by the regression models used in a billing analysis.

Program Strategy

The program strategy presents some unique issues to consider when choosing an analysis method for conducting an impact evaluation. Guidelines based on program strategy are:

Audits. Audit programs are generally classified as information only and therefore do not require impact evaluations but do need program effects evaluations. Audit programs that claim energy savings may be evaluated using a billing analysis, provided the energy impacts of the installed measures are sufficiently large relative to the monthly bill. To conduct an engineering analysis, the measures that were ultimately installed as a result of the audit must be identified, and engineering estimates of savings applied to each of the measures. This may prove to be problematic, since the decision to install a measure may have been influenced by multiple programs. For example, some audit programs direct customers to incentive programs covering recommended measures. In these cases, a joint evaluation of the two programs might provide the most useful information and cost-effective evaluation.

Codes and standards. Codes and standards programs generally affect new construction and, therefore, require an engineering based impact analysis.⁶

Commissioning/operations and maintenance. Commissioning and O&M programs are generally targeted at HVAC systems. Calibrated building energy simulation models should be used to estimate impacts of commissioning programs on new construction. Billing analysis can be used for retro commissioning and O&M projects, provided the impact is sufficiently large relative to the billing data.⁷ Commissioning and O&M programs are especially sensitive to savings degradation over time. A high quality evaluation effort would specify a clear method for quantifying the persistence of savings over time.

Design assistance. Design assistance programs can be classified as information only, and therefore do not require impact evaluations but they do need program effects

⁶ The 2005 Title 24 Building Energy Standards contain provisions for existing buildings upon equipment replacement. Impact evaluation of existing building provisions only may be candidates for billing analysis.

⁷ A retro commissioning program operated by AEC for Southern California Edison averaged 13% energy savings.

evaluations. (See Chapter 9 on Information and Education Program Evaluation.) Design assistance programs targeting new construction that are claiming energy savings will use engineering methods. Most design assistance programs take a comprehensive look at the building design. Whole building impacts may be best analyzed using building energy simulation programs.

Direct installation. Direct installation programs are a form of rebate program where the program bears 100% of the measure cost. These programs generally target small impact measures, such as CFL replacements, low-flow showerheads, faucet aerator, etc. Billing data analysis may be difficult due to the modest impact these measures have on overall energy consumption. Matching participants with utility account numbers may also be difficult due to the simplified participation rules for many of these types of programs. Engineering analysis informed by field observations conducted under IPMVP Option A⁸ may be the most appropriate for direct install programs.

Information and Education. Information and education programs provide only information or educational services, and therefore do not need an impact evaluation. (See Chapter 9 on Information and Education Program Evaluation to make this determination.) However, program effects evaluations are often appropriate and can help to assess the program's justification and determine the program's cost-effectiveness (measured as cost per effect rather than as in the *Standard Practice Manual*⁹ where energy and/or demand savings can be measured).

Financing. Financing programs generally operate in cooperation with information type programs, such as audit or design assistance programs, to help customers finance the energy-efficiency measures. In some cases, they work in combination with incentive programs to help finance the customer portion of the costs of a measure or subsidize the interest rate. "Double-dipping," where savings resulting from the installation of a particular measure are claimed by more than one program, must be avoided if energy savings are claimed as part of the incentive program. Financing programs that claim energy savings may be evaluated using billing analysis provided the energy impacts of the installed measures are sufficiently large. To conduct an engineering analysis, the measures that were ultimately installed as a result of the program must be identified, and engineering estimates of savings applied to each of the measures. In order for this to be done efficiently, program applications need to contain information about the specific measures financed and include information about the equipment replaced.

Rebate – customized. Custom rebate programs use calculations prepared by the program implementer to calculate energy saving, rebate amounts, and customer economics. The initial energy savings estimates can be used in combination with a billing analysis, or M&V can be used to verify program calculations in a calibrated engineering model approach. Custom rebates are used in both retrofit and new construction programs; new construction programs often will use calibrated simulation models.

⁸ (International Performance Measurement and Verification Protocol 2001).

⁹ (* California State Governor's Office 2001).

Rebate – prescriptive. Prescriptive rebate programs provide precalculated rebate or cash amounts to a standard list of measures. An engineering based approach informed from field measurements conducted under the IPMVP Option A can be used for smaller programs. Billing analysis is most often applied to larger rebate programs, provided the load impact is sufficiently large.

Performance Contracting. Performance contracting programs are generally designed with an integrated set of M&V activities. Impact data can be gathered from the M&V reports, provided the M&V activities meet the evaluation standards. Timing of payments and M&V activities for performance contracting programs is generally different than rebate programs, since the payments are made over time and are based on verified energy savings.

Upstream programs. Upstream programs offer incentives, information, and/or training to manufacturers, distributors, and retailers to build, stock and/or promote energy efficient products. Program data on customer locations where efficient products are installed may not be available. These programs can be resource acquisition (being tied to specific installations of acquired savings) or market transformation programs. Chapter 10 on Market Transformation Program Evaluation provides information on how to assess the accomplishments of those upstream efforts that are market transformation initiatives.

End use/measure groups

Guidelines for impact evaluation strategies as they apply to specific end use or measure groups are summarized below:

Appliances. Load impacts from appliance programs often do not affect billing data by more than 10%, thus billing analysis may not be successful for appliance efficiency programs. (Exceptions to this may include refrigerator programs, particularly in homes without electric heat or central air-conditioning or homes that use electricity to heat their domestic water.) Engineering analysis, supported by M&V is a preferred evaluation approach for these types of measures. The partially measured, retrofit isolation approach from the International Performance Measurement and Verification Protocol (IPMVP Option A) is appropriate for small programs; medium and large programs may want to employ the retrofit isolation approach (IPMVP Option B).

Comprehensive. Comprehensive programs involving multiple, interacting measures generally require a billing analysis or building energy simulation approach. Retrofit programs where measure impacts are expected to exceed 10% of the billing data can utilize a billing analysis approach to get a program-level estimate of impacts. Engineering estimates informing a billing analysis (SAE approach) may benefit from field measurements taken under the IPMVP Option A approach. The IPMVP Whole Facility M&V approach (Option C) may be used for programs with few participants. New construction programs generally require a building energy simulation model approach, using a program such as MicroPas or DOE-2. Model calibration should be conducted according to the IPMVP Calibrated Simulation (Option D) approach.

Industrial programs may require the use of a specialized computer model of the process addressed by the program.

Envelope. Programs addressing building envelope improvements may be evaluated using a billing analysis approach provided the expected impacts exceed 10% of the billing data. Residential buildings receiving comprehensive weatherization services generally fall into this category. The impact of building shell improvements as a fraction of commercial building consumption is generally less than residential building consumption, requiring an engineering based analysis. Small programs may rely on engineering equations informed by M&V studies under IPMVP Option A. Larger programs may find greatest value from using a building energy simulation approach, with the models calibrated under IPMVP Option D.

Food service. Programs involving food service efficiency improvements in commercial buildings may use a billing analysis, provided the impacts are 10% or more of the baseline billing data. In commercial buildings such as restaurants and groceries, this may be the case for estimating the program impacts on gas consumption, but will not likely be the case for electricity, unless the customer uses electricity for their major cook line equipment or is in a small facility without central air-conditioning. Engineering analysis, informed by field measurements taken under IPMVP Options A or B is most appropriate for commercial food service equipment efficiency upgrades. Programs involving commercial kitchen ventilation and HVAC issues should be evaluated using a building energy simulation program, calibrated under IPMVP Option D.

HVAC. Programs addressing HVAC system improvements expected to impact energy billing by more than 10% may use a billing analysis. This may be the case in residential buildings, but will not likely be the case in commercial buildings. Engineering estimates informing a billing analysis using an SAE approach may benefit from field measurements taken under the IPMVP Option A. Small programs may use engineering analysis informed by field measurements taken under IPMVP Option A. For medium and large programs a building energy simulation program may be more appropriated with those calibrated to field measurements under the IPMVP Option D.

Lighting. Lighting programs conducted for residential customers will not likely achieve enough savings to allow a billing analysis. Engineering analysis informed by field measurements conducted under IPMVP Option A for small programs or IPMVP Option B for larger programs is the preferred approach. Commercial lighting programs may be evaluated using a billing analysis technique if the impacts are expected to be greater than 10% of the billed consumption. Otherwise, engineering analysis informed by field measurements taken under IPMVP Options A or B is appropriate.

Motors. Due to the relatively small impacts of motor efficiency programs relative to total billed consumption, motor efficiency programs probably needs to be evaluated using engineering analysis. Small programs can use field measurements under IPMVP Option A, while larger programs may be justified using IPMVP Option B to inform the engineering analysis.

Process. If the impacts are sufficiently large, a whole-building billing analysis based on IPMVP Option C may be conducted. Otherwise, engineering analysis informed by field measurements under IPMVP Option A for small programs or IPMVP Option B for larger programs may be the most appropriate methods. Specialized engineering models developed for a specific process can also be used. These models would then be calibrated according to IPMVP Option D.

Refrigeration. Refrigeration is a major end use in grocery stores, thus comprehensive retrofit of refrigeration systems may be analyzed with a billing analysis. Engineering estimates informing a billing analysis (SAE approach) may benefit from field measurements taken under the IPMVP Option A. Otherwise, an engineering-based approach could alternatively (or jointly) be used. Grocery store refrigeration systems generally have significant interactions with building HVAC systems, thus engineering approaches based on building energy simulation modeling are the more appropriate engineering approach. Small programs may use engineering analyses that account for HVAC interactions, informed by field measurements conducted under IPMVP Option A. An approach appropriate for larger programs would be to use building energy simulation modeling calibrated under IPMVP Option D.

Refrigerated warehouse programs may utilize a billing analysis approach under IPMVP Option C if the impacts are sufficiently large. Otherwise, simple engineering equations informed by field measurements taken under IPMVP Options A or B should be used for small programs. A building energy simulation approach using a simulation model suitable for refrigerated warehouses, calibrated according to IPMVP Option D would be more appropriate for larger programs.

Water heating. Water heating programs may sufficiently impact gas consumption in climates with moderate heating loads to allow for a billing analysis. Engineering estimates informing a billing analysis (SAE approach) may benefit from field measurements taken under the IPMVP Option A. Otherwise, engineering analysis informed by field measurements under IPMVP Option A for small programs or IPMVP Option B for larger programs might be the appropriate options.

Water pumping/treatment. If the impacts are sufficiently large, a billing analysis based on IPMVP Option C may be conducted. Otherwise, engineering analysis informed by field measurements under IPMVP Option A for small programs or IPMVP Option B for larger programs might be appropriate. Specialized engineering models developed for a specific waterworks or wastewater treatment processes can also be used. These models are then higher quality efforts if be calibrated according to IPMVP Option D.

A summary of the recommendations for impact evaluation and M&V approach is shown in Table C.4.

Table C.4: Example Guidelines for Impact Evaluation Methodology by Program Type and Size

Program Size	Market Segments	Market Event	End use/ measure groups	Impact as % of billing	Gross Impact Method	M&V Option	Net-to-gross method
All	All	All	Appliances	< 10%	Engineering analysis	A	Survey-based
All	All	All	Appliances	< 10%	Engineering analysis	B	Survey-based
All	Residential, Commercial	All	Comprehensive	< 10%	Building energy simulation	D	Survey-based
All	Residential, Commercial	New construction/ Remodel/ Renovation	Comprehensive	> 10%	Building energy simulation	D	Survey-based
All	Residential, Commercial	Retrofit	Comprehensive	> 10%	Billing analysis	A optional	Econometric
All	Agricultural, Industrial	All	Comprehensive	< 10%	Engineering analysis	A	Survey-based
All	Agricultural, Industrial	New construction/ Remodel/ Renovation	Comprehensive	> 10%	Engineering analysis	A	Survey-based
All	Agricultural, Industrial	Retrofit	Comprehensive	> 10%	Billing analysis	C	Survey-based
All	All	New construction/ Remodel/ Renovation	Envelope	> 10%	Building energy simulation	D	Survey-based
Small	All	Retrofit	Envelope	< 10%	Engineering analysis	A	Survey-based
Medium, Large	All	Retrofit	Envelope	< 10%	Building energy simulation	D	Survey-based
Small	All	Retrofit	Envelope	> 10%	Billing analysis	A optional	Econometric
Medium, Large	All	Retrofit	Envelope	> 10%	Billing analysis	A	Survey-based
Small	Commercial	All	Food service	< 10%	Engineering analysis	A	Survey-based
Medium, Large	Commercial	All	Food service	< 10%	Building energy simulation	D	Survey-based
All	Commercial	Retrofit	Food service	> 10%	Billing analysis	A	Econometric
All	Commercial	New construction/ Remodel/ Renovation	Food service	> 10%	Building energy simulation	D	Survey-based
All	All	Retrofit	HVAC	> 10%	Billing analysis	A	Econometric
All	All	New construction/ Remodel/ Renovation	HVAC	> 10%	Building energy simulation	D	Survey-based
Small	All	All	HVAC	< 10%	Engineering analysis	A	Survey-based
Medium, Large	All	All	HVAC	< 10%	Building energy simulation	D	Survey-based

Table C.4: Continued

Program Size	Market Segments	Market Event	End use/ measure groups	Impact as % of billing	Gross Impact Method	M&V Option	Net-to-gross method
Small	All	All	Lighting	< 10%	Engineering analysis	A	Survey-based
Medium, Large	All	All	Lighting	< 10%	Engineering analysis	B	Survey-based
Small	All	Retrofit	Lighting	> 10%	Billing analysis	A	Econometric
Medium, Large	All	Retrofit	Lighting	> 10%	Billing analysis	B	Econometric
Small	All	New construction/ Remodel/ Renovation	Lighting	> 10%	Engineering analysis	A	Survey-based
Medium, Large	All	New construction/ Remodel/ Renovation	Lighting	> 10%	Engineering analysis	B	Survey-based
Small	All	All	Motors	< 10%	Engineering analysis	A	Survey-based
Medium, Large	All	All	Motors	< 10%	Engineering analysis	B	Survey-based
Small	Agricultural, Commercial, Industrial	All	Process	< 10%	Engineering analysis	A	Survey-based
Medium, Large	Agricultural, Commercial, Industrial	All	Process	< 10%	Engineering analysis	B	Survey-based
All	Agricultural, Commercial, Industrial	Retrofit	Process	> 10%	Billing analysis	C	Survey-based
All	Agricultural, Commercial, Industrial	New construction/ Remodel/ Renovation	Process	> 10%	Engineering analysis	B	Survey-based
All	Commercial	Retrofit	Refrigeration	> 10%	Billing analysis	A	Econometric
All	Commercial	New construction/ Remodel/ Renovation	Refrigeration	> 10%	Building energy simulation	D	Survey-based
Small	Commercial	All	Refrigeration	< 10%	Engineering analysis	A	Survey-based
Medium, Large	Commercial	All	Refrigeration	< 10%	Building energy simulation	D	Survey-based
Small	Agricultural, Industrial	All	Refrigeration	< 10%	Engineering analysis	A or B	Survey-based
Medium, Large	Agricultural, Industrial	All	Refrigeration	< 10%	Building energy simulation	D	Survey-based
All	Agricultural, Industrial	Retrofit	Refrigeration	> 10%	Billing analysis	C	Survey-based
All	Agricultural, Industrial	New construction/ Remodel/ Renovation	Refrigeration	> 10%	Building energy simulation	D	Survey-based

Sampling Criteria

Establishing evaluation priorities and methods is an exercise in balancing the available evaluation budgets with meeting the evaluation goals for each program without placing too much burden on programs with limited resources. Applying evaluation techniques and choosing sample sizes that are appropriate given the program size, budget, and risk to the portfolio can maintain this balance. The evaluation approach guidelines above direct more rigorous evaluation efforts toward larger programs. This approach would also direct more robust sampling strategies at larger programs.

A high quality evaluation plan would examine the program characteristics, evaluation resources, and the potential tradeoffs between spending resources on increased sample size versus using alternative evaluation methods, and/or approaches and the potential effects on precision and minimization/mitigation of bias. Then the selected methods and sample sizes being recommended would be selected for the most reliable overall evaluation that meets the evaluation goals (to include tradeoffs between different types of evaluations that would provide value at this time and the various methods and samples needed for each of these).

Data Requirements

Impacts at the measure level are desirable, but not required under the Energy Efficiency Policy Manual, Version 2 (the guiding document at the time of the drafting of the Framework). It is recommended that, if at all possible, program net impacts for energy and demand be reported by costing period. All quality impact evaluations include an estimate and discussion of the uncertainty, which includes sampling error and uncertainty in engineering calculations and field measurements as discussed in Chapter 12 and 13 in this Framework. Potential biases and their influence on program results should be identified and reported. For ease of use, regardless of the error bound level (10%, 15%, 25%, or other), the Framework recommends that all uncertainty calculations be expressed at 90% confidence, to facilitate the calculation of portfolio-level savings and uncertainties.